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# American Cinematographer

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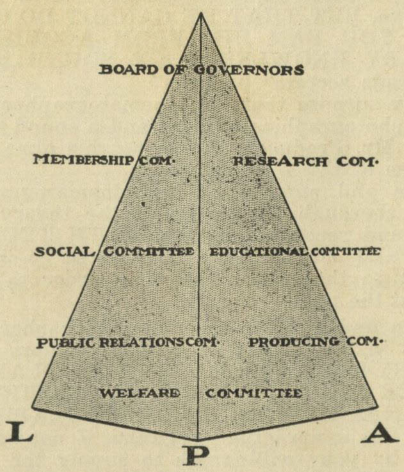


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# An Open Letter

Mr. Producer: At one of the recent meetings of the Technical branch of the Academy of Motion Picture Arts and Sciences, Mr. Fred Pelton reported in a most interesting way on the results of an investigation which he recently conducted in eastern laboratories where the technique of sound pictures has been developed and is undergoing rapid stages of progress.

Mr. Pelton expounded an axiom which expresses the consensus of opinion of the research scientists who are responsible for the remarkable development recently brought about in this new method of picture presentation: "THE SUCCESS OF SOUND PICTURES IS DEPENDENT, TO THE EXTENT OF NINETY PER CENT, UPON THE TECHNICIANS IN CHARGE OF PRODUCTION."

During the actual filming of a sound picture such technicians are the SOUND ENGINEER as well as the CINEMATOGRAPHER.

The first represents the keystone upon which the sound edifice is built; the second represents the keystone upon which rests the visual edifice.

At the present time, with perhaps one exception, the producers interested in sound pictures have been prevailed upon to consider the rendition of SOUND of foremost importance, in fact to consider it as the sole foundation upon which rests the success of a production. Perforce, they have sadly neglected the other technical branch—CINEMATOGRAPHY.

The work of the cinematographer is primarily a work of limitation—technical limitations due to the complexities of the elements that the cinematographer has at his disposal for the realization of the accomplishments which are required from his profession.

These limitations create difficulties and problems the solution of which the cinematographer has made through study, love for his art, interest in the whole motion picture industry, considerable personal and financial sacrifice and no little ingenuity.

The adjunction of sound to pictures still increases the number of limitations in a decided and serious manner.

The greatly reduced mobility of the camera, for example, brings about serious complications in the lighting of sets and especially in the lighting of that so important factor in picture production, the close-up.

This same lack of mobility of the camera involves the use of lenses of a range of different focal lengths which inevitably results in a falsity of perspective rendering in scenes which should follow each other with the greatest smoothness of action and visual interpretation. A distortion of perspective of two scenes such as a long shot and its corresponding close-up is offensive even to the untrained eye and severely criticized by the most lenient audience.

These two examples are but two of numerous major and minor limitations brought about by the sound picture which increase greatly the problems of the cinematographer in the practice of his profession.

The cinematographer must develop a new photographic technique most adaptable to sound pictures and is effectively hard at work in order to solve his problems.

Now, Mr. Producer, WHAT ARE YOU GOING TO DO TO ENCOURAGE AND HELP THE CINEMATOGRAPHER SO THAT HE MAY CARRY THIS WORK FOR YOUR BENEFIT? Are you going to do as you have done in the past—that is, accept the cinematographic achievements as a matter of fact, as something due to you, with utter disregard for the cinematographer's efforts, or, are you going to see to it that the cinematographer receives that encouragement and help which are vitally necessary for the rapid progress of pictures.

Up to the present time, you, Mr. Producer, have shut all doors and intrenched yourself behind a wall of TRADE SECRETS, and who are the people who are developing these trade secrets—men trained IN A FEW WEEKS to acquire the knowledge of sound recording and thrown into the complexities of motion picture production before they have the slightest opportunity to acquire any knowledge of the production exigencies which have cost you many sleepless nights since the very beginning of the motion picture industry.

Did it ever occur to you, Mr. Producer, that you are right now destroying the solid foundation upon which the motion picture industry has been built by technicians, directors, writers, by all your co-workers, in one word, because you have been made to believe that sound is the sole feature upon which depends the success of the product you are giving YOUR public?

Has it ever occurred to you, Mr. Producer, that our public has been accustomed to a standard of quality the appeal of which CANNOT BE SUPERSEDED BY SOUND, NO MATTER HOW PERFECTLY SOUND MAY BE REPRODUCED?

Has it ever occurred to you, Mr. Producer, that the cinematographer has been for the past thirty years the technician ON THE SET?

Has it ever occurred to you that each and every one of the cinematographers represent the accumulation of thirty years of experience in motion picture photography, that he has sufficiently adapted himself to its technique, and that he has succeeded in bringing motion picture photography to such a high standard that he is conceded to be the GREATEST EXPONENT OF THE ART OF PHOTOGRAPHY IN THE WORLD?

Has it ever occurred to you that the Cinematographer has chiefly devoted his time to the study of the technique of photography and has devoted his energy to the application of such technique to motion picture photography?

Are you aware of the fact that LIGHT which is the chief energy with which the cinematographer has to work, is governed by physical laws and theories closely related, so to speak, to the laws governing ELECTRICITY and akin to the laws governing SOUND?

Did it ever occur to you that the cinematographer has year after year, day after day applied these laws and theories to the practical solution of his problems and that through this fact the most fertile ground for the understanding of electrical and sound phenomena, especially those applied to motion pictures, is to be found within the cinematographer?

Has it ever occurred to you, Mr. Producer that the cinematographer has also been a student of the dramatic art and has successfully proven that he could, in spite of all odds, adapt COLD, REAL, IMMUTABLE physical laws to artistic expressions which have received the sanction of your patron—the public?

Has it ever occurred to you that the cinematographer can help you in bringing sound pictures to the success they deserve, BUT THAT HE CANNOT DO THIS RAPIDLY IF YOU BAN HIM FROM ACQUIRING THE NECESSARY KNOWLEDGE OF SOUND by erecting absurd "trade secrets" barriers?

You may surmise that the cinematographer expects to become a photographic engineer and a sound engineer at once—no, Mr. Producer, this is not his aim; this is not the purpose of this open letter.

The aim and purpose of the cinematographer is to acquire a thorough knowledge of the theory and practice of sound recording so that BOTH TECHNICIANS ON THE SET may be in a position to co-operate with each other to the fullest extent in order to obtain the results that the public expects.

This aim and purpose the cinematographer will reach and fulfill in due course of time regardless of all barriers and BY FAR MORE RAPIDLY THAN ANY SOUND ENGINEER CAN ASSIMILATE THE INTRICACIES OF FIRST CLASS MODERN CINEMATOGRAPHY; but the time that this assimilation will take, if not reduced to a minimum by your willingness to supply the cinematographer the means to arrive at it, will cost you a pretty penny and it may even cost the industry the good will of the public which very soon becomes tired of the presentation of an inferior product.

It is also a matter of better business. The more responsibilities are divided the less efficient is the machinery which turns out the product. And in this case the machinery is responsible for the NINETY PER CENT of the success of the enterprise.

(*Concluded on Page 23*)

# The Acoustics of Sound Recording Rooms

*By* PAUL E. SABINE
Riverbank Laboratories, Geneva, Ill.

Presented at the Lake Placid convention of the Society of Motion Picture Engineers, September 26, 1928

In dealing with this subject, one must of necessity be concerned with general considerations. Each sound recording room presents special problems calling for particular solutions, which arise from conditions that are imposed by necessities which are quite other than acoustical. In the particular case, therefore, the designer of a sound recording studio has to include in his general design problem, the special conditions that must be met in order to record sound faithfully, and free from extraneous noise.

The first of these general considerations to be urged is that the matter of acoustic conditions be included from the very first in the development of the plans. This would mean that the site, in the case of a new building would be selected with the probable conditions as to noise in mind. The noise of heavy traffic, of street cars, or of elevated railways, being transmitted in part by way of the earth is almost impossible to eliminate. If the recording room is to be included in an old building, careful consideration should be given to its location with reference to machinery or other existing sources of noise. The difficulties of successful sound insulation in a building already constructed are frequently extremely great.

Having admitted the acoustical problem as of prime importance in the studio or stage layout, the designer should undertake to secure definite quantitative data on the various specific problems involved. In a field as new as is the recording of sound in connection with motion pictures, there will have to be considerable experimentation as to the acoustic conditions for recording which will produce a record that most nearly simulates music and speech as heard by an audience from an actual stage, yet the principles governing the behavior of sound within closed spaces are well known, and quantitative data for producing the desired conditions can be had, once these conditions are determined. Having determined the acoustical conditions that are desirable it is not necessary to guess at or experiment with means of obtaining these conditions. Let me illustrate by an example. In listening to a stage production, the audience hears the voices of the actors as they are modified by the acoustic conditions of the actual stage. What is the best means of securing this illusion in the case of the talking moving picture? Is it to make a record that is entirely free from "room effects," and then put in the room effects by reproduction upon a stage that will introduce them, or will it be better practice to record under conditions that will include the "room effects" in the sound record? Only trial can answer this question, but once answered, I think it is safe to say that our knowledge of acoustics is at the point where the desired conditions for recording, whatever they may be, can be secured without further experimentation.

At the risk of indulging in the thankless task of carrying coals to New Castle, by speaking of matters upon which many of you are already informed, may I very briefly outline the subject of the acoustics of rooms in general as an introduction to the consideration of the specific problems of the sound recording room.

Sound consists of the rapid to and fro motion of the particles of the air or other elastic medium. This motion is propagated from particle to particle with a velocity of about 1120 ft. per second at ordinary temperatures. This vibrational motion of the individual particles results in a cyclic variation of the pressure, above and below the normal atmospheric pressure which in turn is accompanied by a corresponding fluctuation in temperature—a rise in the compression phase, and a fall in the rarefaction phase.

As a form of energy, sound can disappear from an enclosed space in which it is produced only by transmission or by absorption. The latter consists in the dissipation process of transforming the regular vibrational motion of sound into the random molecular motion of heat, and occurs only when work is done against dissipative forces, such as by non-elastic compression or flexure of soft materials or by motion to and fro in the minute channels of porous materials. When sound is incident upon a solid surface, part of its energy is reflected, part transmitted through the solid, and part absorbed. For purposes of the interior acoustics of rooms, it is unimportant whether the energy disappears by absorption or by transmission, and since in general the latter is a relatively small proportion of the unreflected energy, we include it in the absorption. The absorption coefficient depends in a marked degree upon the pitch, to some extent upon the quality, that is, whether the sound is pure tone or one with harmonics, and, probably upon the intensity, intense sounds being absorbed more strongly than faint sounds.

From the foregoing, it is apparent that sound once produced within a room will persist for an appreciable length of time after the source has ceased, due to the fact that it requires time for the multiple reflections necessary to reduce its intensity to inaudibility. This persistence is technically called reverberation and is measured by the time required for sound to decrease to 1/1,000,000 of its initial intensity. The phenomena of reflection, absorption, and reverberation can all be illustrated by means of photographs of sound pulses taken by means of electric sparks.

Another phenomenon that occurs in rooms is that of interference. This results from the undulatory nature of sound. As a simple illustration consider the case of a train of waves incident upon a plain surface. At points, at which the reflected wave train travels an odd number of half wave lengths further than the oncoming, the condensation of one will coincide with the rarefactions of the other and assuming equal intensity the pressure change at such points will always be zero. For an even number of half wave lengths difference, the two pressure changes will reinforce each other. Thus we have in a room with a sustained source of sound of fixed frequency a point to point variation in the intensity, which changes with changing pitch at the source, with the position of the source, and with any shift in the position of reflecting surfaces within the room. As a general rule, this inequality of distribution is not an important factor in the acoustic properties of a room. Concentration of reflected sound by extended curved contours, may accentuate these inequalities to the point of being a real acoustical defect.

Echo is the distinct repetition of a sound of short duration, by reflection from solid surface or surfaces. In order to separate two sound impulses the time interval between must be of the order of 1/20 of a second or less. This means that the reflecting surface must be at least 28 feet from the observer. Multiple echoes which merge into each other constitute reverberation. Concave reflecting surfaces serve to produce localized echoes.

By far the greatest number of cases of acoustic difficulties arise from excessive reverberation. Its effect is to prolong the separate elements of speech or music so that these run into each other, thus lowering intelligibility and sharpness of enunciation. Thus suppose for example that each syllable of speech in a room persists for three seconds after it is spoken. (Not an unusual length of time in an empty room.) Speaking at an ordinary rate, a speaker will utter fifteen syllables in this length of time. There will be thus at any time the residue of sound from fifteen preceding syllables competing with the direct sound at the ear of the auditor with resultant confusion and loss of distinctness.

Without going into the mathematical analysis of the theory nor the very careful experimental work that has been done by Wallace C. Sabine and others in verification of this theory, we may state the laws of reverberation as follows:

1. For a sound of fixed initial intensity in two rooms, the periods of reverberation are directly proportional to the volumes and inversely proportional to the total absorbing powers of the two rooms, the total absorbing power of a room being defined as the sum of the products of the area of each surface exposed to sound multiplied by the absorption coefficient of that surface.
2. In a given room, the duration of audible sound after the source has ceased is proportional to the logarithm of the initial average intensity of sound in the room.

Law 1 may be put in the form of the well known reverberation equation

$$T = .05\ V/a$$

wherein T is the time required for the sound intensity to decrease to 1/1,000,000 of its initial value, V is the volume of the room in cubic feet, and is the sum of the products of area and coefficient for all surfaces in the room.

With the data at hand for determining $a$, it is apparent that we can compute the reverberation time for any room. One immediately raises the question, as to what the reverberation time as thus computed should be for an acoustically good room. The answer is arrived at by seeing what T is for rooms that are acoustically good. Figure

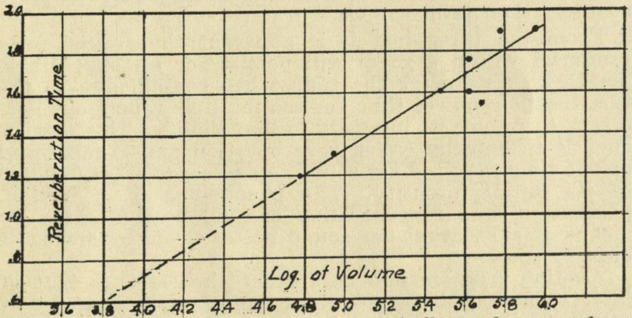



Fig. 1—Reverberation times of acoustically good rooms of different volumes.

1 shows the values of T for six different auditoriums which are recognized as being acoustically very satisfactory for both music and speech. Included also are two other rooms, one too reverberant, the other too "dead." T is plotted as a function of the logarithm of the volume, and the graph shows that longer reverberation times as defined above are allowable for large than for small rooms.

We thus have a very usable criterion of excellence for rooms that are used for audience purposes. Thus for example, if the volume of a proposed room is 200,000 cubic feet then the absorbing power, including that of the audience should be 6667 units in order to give a reverberation time of 1.5 seconds, the value which according to the graph is desirable in a room of this size. If the figured total absorbing power of the room surface and the audience is less than this, then there should be sufficient area of absorbent treatment introduced to bring the total up to the desired value. It should be said that the departure from the values shown without materially affecting hearing conditions is fairly large, certainly as great as 5% and possibly as great as 10%, so that the graph serves simply as a working basis for designing rooms with comfortable acoustics.

Coming now to the question of the proper reverberation time for sound recording rooms, I have to confess the lack of any very precise data. As you know, the early practice in phonograph recording and in radio broadcasting was to cut down sound reflection to the limit, by the use of heavy drapes hung well out from the wall and over every foot of available surface. While this practice serves to eliminate any trace of room effects, it at the same time produces a dull, lifeless quality to music, particularly, that is extremely trying to artists and is easily perceptible to discriminating auditors. Gradually the tendency toward less deadening and longer reverberation times has grown up. In 1926, I conducted a series of tests for station WLS in Chicago to find out whether differences in room conditions were perceptible to radio listeners, and as to what condition was preferred. It was arranged to vary the absorbing power of the studio in three steps by the removal of drapes, thus increasing the computed reverberation time from .25 to .64 seconds. In this test, the same short program was broadcast under each of the three conditions, and the preference of the radio listeners was asked for. Of the 121 replies received, only 16 expressed a preference for the least reverberant condition, while 73 preferred the most reverberant. It was not possible to carry the experiment to still longer reverberation periods. It is interesting to know that the reverberation time of .64 is not far from what one would predict from extrapolating the graph of Fig. 1 to the volume of this particular studio. From my own observations and experience and what I have been able to gather from the experience of others, I am inclined to believe that what we consider good auditorium conditions will come to be recognized as not far from good recording conditions. This of course does not mean that recording studios do not as a rule need some absorbent treatment. As a matter of fact they do. When we remember that in an auditorium 2/3 to 4/5 of the total sound absorption is supplied by the audience, and that there is usually no audience in the recording room, it is obvious that the deficiency will have to be made up by special absorbent treatment of some kind. In fact, in large stages the amounts of absorbent treatment necessary to give good audience room conditions will be rather formidable. For example a room with a volume of 500,000 cubic feet, would normally have an audience of 2500 people, with an absorption of 11,500 square feet of perfect absorption. At least 23,000 square feet of felt with a coefficient of .50 is required to reduce a stage of this size to good audience room conditions. Now 500,000 cubic feet would be a small motion picture stage according to present practice, so that it appears plain that to provide proper acoustical conditions on the very large stages now used for the silent motion pictures requires a considerable outlay for sound absorbents. It is apparent that from the standpoint of economy, it is the part of wisdom to provide in the initial layout for the necessary acoustical treatment. Frequently it is possible through the exercise of a little ingenuity to utilize materials for the purpose which are much cheaper than the usual types of materials now used for an acoustical correction in auditoriums. In the latter, requirements of appearance and decoration add appreciably to the cost of the materials employed.

Speaking entirely from the standpoint of an outsider knowing only incidentally of the requirements other than acoustical, of a motion picture stage, I would venture the suggestion that possibly the requirements of sound recording would call for radical departure from the present plan of having very large stages designed to accommodate simultaneously a number of sets, to the plan of having a number of smaller, separate stages acoustically insulated from each other. Certainly the problem of the control of reverberation in moderate sized rooms is much simpler than in extremely large rooms.

### The Effect of Absorbent Treatment on Tone Quality

Practically all musical tones are complex. That is, they consist of a fundamental tone with its series of harmonic overtones.

It has long been recognized that the phenomenon of reverberation may affect the quality of musical tones produced in a room. In the open air, at a distance from any reflecting surface and at short distances from the source of sound it may safely be assumed, I think, that the wave in the air is identical with the wave form produced by the source. That is to say the quality of the tone does not materially change as the wave advances. But in a room, the resultant vibration at any point is that due to the sound coming directly from the source combined with that which has been reflected from the bounding surfaces of the room. Now if these reflecting surfaces, reflect all the components of the complex tone in the same degree, the quality of the reflected sound will be identical with that of the direct sound. But as a matter of fact, practically all materials are selective to a greater or less degree, so that, theoretically at least, the quality of reverberant sound is altered by the room.

Fig. 2 shows the absorption coefficients of hair felt of different thicknesses from ½″ to 3″ over the frequency range from 128 to 4096 vibrations per second.

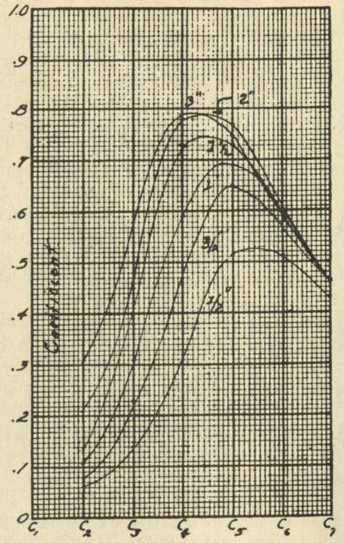



Fig. 2—Absorption co-efficients of felt of various thickness.

It will be observed there is a maximum of absorption that shifts to lower frequencies as the thickness of the material is increased. The ratio of the maximum to the minimum absorption is 6.2 for 1″ material. This ratio is reduced 2.5 when we get to a thickness of 3″. This selective absorption is characteristic of all porous materials. One obvious method of ironing out the curve is to increase the thickness. This however, is an expensive procedure, and as a practical matter, is sometimes difficult. It is also possible to reduce the peak absorption relatively to the absorption at other frequencies by surfacing the porus material with a flexible though impervious membrane. Fig. 3 shows the effect of cementing a painted fabric to the surface of 1″ felt. This, however, has the disadvantage of producing a decrease in the general efficiency of the material.

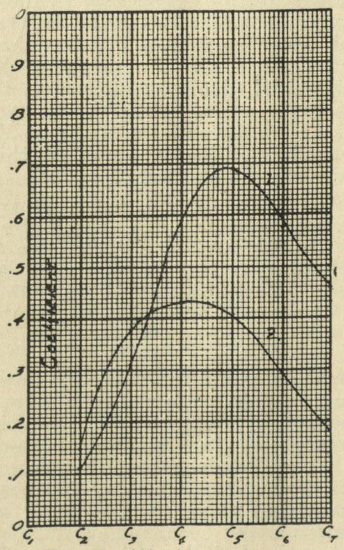



Fig. 3—(1) Absorption coefficients bare felt. (2) The same with an impervious membrane.

The effect of this selective absorption is pronounced in rooms in which the major portion of the total absorbing power is supplied by a selectively absorbing material. The high pitched components of music or speech are dissipated more rapidly, resulting in a preponderance of the lower tones producing a peculiar hollow effect, which is far from pleasing to the ear, and which in sound recording may result in a serious over emphasis of the low tones.

We have had occasion in our laboratory to solve this problem in the treatment of the room in which the response of loudspeakers is measured. By a somewhat fussy arrangement of the absorbent material we have been able to secure conditions such that the measured response is quite independent of the relative positions of the source and the pick-up showing that the reflection of sound at all frequencies is negligibly small. Fig. 4, shows the

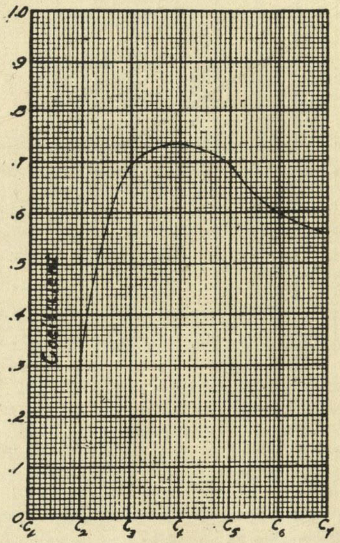



Fig. 4—Absorption co-efficients of two ½″ layers of felt with intervening air space.

increase in absorption of sound of low frequencies that can be secured by properly disposing two layers of ½″ hair felt with reference to each other. The work of Dr. Wente at the Bell Laboratories as well as further uncompleted work in our laboratory indicates that absorbing structures can be designed that will give much more nearly uniform absorption over the pitch range than do simple porous materials. Whether or not such conditions make enough difference in the quality of the sound record to warrant the pains and expense to secure them, is a question that can only be answered by recording experience. The point here emphasized, is that if necessary for good recording they can be secured.

**Extraneous Noise**

Freedom from outside noises is more a matter of attention to numerous details of construction than of building magic sound proof walls. That term, "sound proof wall," like the term, "projectile proof armor," is a purely relative one. One thinks of an eight-inch brick wall as fairly sound proof, yet sounds that are not so loud as to be painful can easily be heard through such a wall. On the other hand, much less formidable constructions than an eight-inch brick wall will serve to exclude sounds of ordinary intensity. One finds the explanation of the difficulties of complete sound insulation in the extreme sensitivity of the ear, and the wide range of intensities to which it responds.

During the last nine years, a great deal of work on the transmission of sound by partition walls has been done at the Riverbank Laboratories. The results can be summarized only very briefly for the purpose of this paper. The outstanding facts are as follows:

1. For what may be considered as continuous masonry, including walls of gypsum tile, clay tile, solid plaster, and brick, the reduction of sound in transmission increases according to a fairly definite law with the increasing weight of such constructions.

2. Felts and other fibrous porous materials, used alone, are not effective sound insulators as compared with stiff, heavy, and impervious materials. As generally employed

for sound insulating purposes either as an inner-lining for double constructions, or as a fill between wood members in single construction, they do not produce any very marked effect in increasing the degree of sound insulation.

3. Double wall constructions furnish a higher degree of sound insulation than do single walls of equal weight. The greater the structural and spatial separation of the two component structures, the greater the degree of sound insulation afforded.

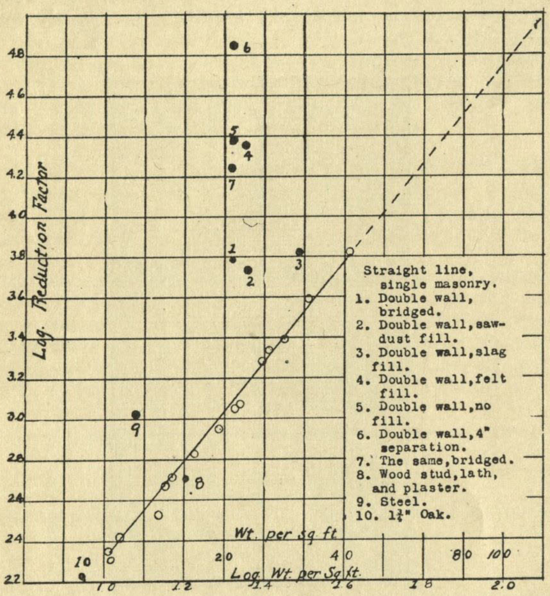



Fig. 5—Reduction of sound in transmission of various types of partition walls.

Figure 5 presents the results of some of the tests on the transmission of sound by more usual types of wall construction. The vertical scale gives the average logarithm of the reduction of sound intensity for 17 different tones ranging from 128 to 4096 vibs/sec. The horizontal scale gives the logarithm weight per square foot of the partition structure. The points lying along the straight line are for the masonry partitions, including walls of clay and gypsum tile, both hollow and solid, and of different thicknesses, as well as solid plaster on metal lath, from 1½" to 4½". The double partitions were of gypsum tile, with complete structural separation between the single units. The effects of the various types of fill as well as the effect of bridging the intervening air space are shown. Unless otherwise indicated, the separation between the double walls was 2 inches.

It appears then that when insulation from external noise is necessary the double wall construction is the most effective means of securing it with wall construction of moderate weight. Equally important is the matter of preventing the entrance of sound by means of openings, including doors and windows, and ducts for heating or ventilation. The ventilating system of a talking moving picture stage requires especial care in the planning. Quiet operation should be a first consideration in specifying the fans, pumps and other machinery employed in air conditioning. Flexible canvas coupling between the fan and the ducts should be specified to prevent the conduction of vibrations along duct walls. The cross section of ducts should be figured large enough to allow lining with sound absorbent material. Properly constructed baffles of sound absorbing material, can be effectively used in reducing the passage of noise through conduits. It is good practice to surface exterior walls with cork and plaster, particularly in cases where ducts leading to and from rooms that should be acoustically separated run parallel or close to each other. It should be remembered that so far as the admission of sound is concerned, there is no difference between intake and outlet ducts.

A system of sound insulation is no more effective as a whole than its least effective element. Pains should therefore be taken to provide doors and windows which are as "sound proof" as possible. A double door of as heavy construction as feasible, with the maximum possible separation of the two units, and provision for closing tightly, is the best means so far available. Care should, of course, be taken to procure a proper degree of insulation of motors, generators or other sources of vibration from the main structure of the studio or stage. Structural vibrations may be transmitted with amazing facility through an entire building.

It is fairly clear as stated, in the outset, that freedom from disturbing noise, is a matter of careful detailed planning. The foregoing serves to indicate along broad lines the possible sources of trouble and the means by which these troubles may be avoided. On the whole, the acoustical problems of sound recording rooms are not seriously troublesome, if taken into account from the beginning. They may be extremely annoying if omitted and brought in only as an after thought.

# *Cine Film Perforation And Its Measurement*

By Dr. H. Lummerzheim

Although cinema film and also the toothed drums of cinematograph cameras, etc., have been standardized, difficulties occur at times in the conveyance of the film or in the way of damage to the perforations in which cases it is desirable to ascertain if the perforation of the film is correct. For this purpose an appliance for measuring the pitch of the film (i.e. the distance between the centers of two successive perforations) is not all that is required; it is also necessary to know the degree of accuracy which may reasonably be expected of the perforation.

Following perforation every film suffers a certain shrinkage which has already started when the carton of film is opened by the user. According to the international standard the pitch of the film at the time of perforation is between 4.75 and 4.77 mm. for negative and between 4.75 and 4.76 mm. for positive. Under favorable conditions the shrinkage should not exceed more than 1.5 per cent.

The latter factor thus means that the pitch does not fall below 4.68 mm. as the result of shrinkage.

In ordinary practice the following are the values of films in various states as regards pitch: with raw film, as put into the camera or printing machine, 4.75 to 4.73 mm.; after development, 4.74 to 4.72 mm., provided the drying is not excessive. In the course of time the pitch becomes still smaller, in the case of positive, as also negative, film, so that it may reach a value of 4.68 mm. in the case of a very old and fully dried positive. In the case of negatives which are usually carefully handled and stored in tins, such great shrinkage is uncommon. They usually have a pitch not less than 4.71 mm.

Hitherto vernier scales or measuring microscopes have been used for determining the pitch. A new and much simpler method has quite recently been introduced by the Agfa Company. On a light metal bar of about 175 mm. length and 50 mm. width, a strip of film is reproduced with perforations of somewhat larger pitch than the usual cine film.

In order to determine the pitch of any film the latter is laid on this measure or meter and a note made of the position of the perforations relatively to those marked on the measure. From the amount of the difference between the two, the pitch of the sample film may be read directly on a scale provided on the measure. Study of the principle of this method of measurement, together with a highly exact construction of the measure, has made it possible to obtain readings of the pitch of film correct to one-thousandth of a millimetre without the aid of any optical appliance or calculation.

The rationale of the method, and further details concerning it are contained in a paper by the author published in "Kinotechnik," Heft 73, page 352. Patents for the pitch measure have been applied for in all the chief countries. (Communication from the Agfa Film Works of the I. G. Farbenindustrie A. G.)

# *Kinograms*

By H. E. Hancock

**Associate Editor and Business Manager of Kinograms**

Probably most of you have heard the story of the mother sitting in a street car with her sixteen children and the conductor asking her: "Are all these kids yours or is this a picnic?" and her reply—"They're all mine and it is no picnic." That's a newsreel in a nutshell, or, I should say, it illustrates the job of a newsreel editor.

While he has never known the pains of childbirth he has to be mother and father to a tremendous family all over the world. Seventy-five per cent of his free lance family he has never seen and probably never will see. Their letters have had to be answered pronto, their complaints fully investigated, they have to be advised, cajoled, carefully praised, carefully scolded, and treated like human beings or they will run away from home.

I have been asked to write how our newsreel gets the news in motion pictures. There are various and devious ways. First of all come its out of town cameramen who watch their local newspapers and use their judgment as to what is important enough. This requires special training because people are prone to forget that a newsreel is a NATIONAL institution. Local pictures are easily recognized, but it takes good judgment to pick out subjects that will please those in California and New York equally as well.

Other avenues for the getting of news are a constant and diligent reading of newspapers and magazines in the home office. This also takes special aptitude. I have known many newspaper men to fail on a newsreel desk job because they were unable to recognize the picture value in a story. You cannot run a picture in the newsreel of a snake, a rat, a cockfight or anything that suggests cruelty to animals. The obscene or suggestive are absolutely taboo no matter what the newspapers may do with their stills. More infants in baby show pictures who accidentally revealed their sex have been "murdered" by censors than in the Armenian massacres.

I personally believe that we newsreel editors are a trifle too cautious. There has always been an unwritten rule against showing pictures of criminals on their way to prison, and I have yet to find an owner of a newsreel with the temerity to change this policy. And yet what more powerful deterrent to crime could there be than the blasting publicity of a newsreel picture proving that "crime does not pay." Of course this sort of thing could be overdone and it would have to be carefully handled. but show me a police force or any law and order official or society that would not welcome this aid.

One of the newsreels did depart from this rule in the case of Gerald Chapman and showed pictures of him in his cell in Connecticut where he was smoking a cigar and reading newspapers. But with all due deference to my confrere I think a grave mistake was made in the handling of these pictures especially in the posing of the man and the wording of the titles. The impression one received after looking at this subject was one of glorification of this murderer. In one theater where I saw this reel he was actually applauded as a romantic figure. This was very bad and brought a flood of protests from exhibitors. It simply emphasizes the extreme care to be taken in handling pictures of this kind. However, I am afraid I am digressing somewhat.

To go back to news gathering. Another source is the tipster, generally the editor of a live newspaper who earns a bit of money on the side. Every newsreel has two or more of these newspaper tipsters who give service day and night. A newsreel editor can never depend upon an unbroken night's sleep. At any time he must expect to be disturbed. The world's events never stop occurring, so a newsreel editor has to keep equal pace if he wants to hold his job.

There are also the avenues of chance through which information, or "tips" come in, but these are mostly strokes of luck. Personally I always welcome the opportunity of meeting someone who has travelled extensively. Time and time again the traveler, who generally has no news picture sense, will describe something going on in some corner of the world that has never been shown in a newsreel, for although one would think that almost everything had been photographed such is not the fact. There are heaps and heaps of subjects suitable for newsreels and it only remains for somebody with a sense of news pictures to dig them out.

A news reel gets its news through channels of observation, conversation, tips, luck and being constantly "on the job," and woe betide the humble worrying editor if he slacks for a second's time.

# *About Elstree, England*

*A Few Words on the Largest Producing Plant in England from a Britisher's Angle*

By Leslie Eveleigh, F. R. P. S.

Elstree is often called, over here, Britain's Hollywood. I have yet to discover why, because although there are two lots producing pictures within half a mile of one another, and the B. I. P. Studios are the largest in England, Elstree will have to go a long way yet before it can call itself a second Hollywood. When it comes to the actual studio, however, the B. I. P. Studios are probably as well equipped in every way as any in the world.

They consist at the moment of two large stages about 300 feet by 200 feet by 40 feet high, with two more stages of the same size in course of erection which will be ready for occupation in about three months time. Two fair sized buildings constitute the laboratories and the paint shops, carpenters' shops and mills, plaster shop property rooms, etc., are as complete as anything I saw in the actual Hollywood.

Originally laid down by J. D. Williams, the Elstree plant is now run by a British syndicate at the head of which is John Maxwell, who lately tied up with First National-Pathe, and distribution of all films produced on this lot is handled by a subsidiary company, of which John Maxwell is also managing director, known over here as Wardour Films.

Every kind of modern lighting equipment is to be found in use on the floors of the Elstree plant, including incandescent, the new mercury vapour, which gives a reflected red ray and is very suitable for use, in conjunction with incandescent, on panchromatic stock. Most of the new German lighting equipment is also to be found here and several well-known camera men and directors have worked in these studios, and expressed themselves as delighted with the facilities. Among the cinematographers who are known to members of the A.S.C. are Rene Guissart, Roy Overbaugh and Carl Freund, the German, who turned on Variety (Vaudeville, in this country) and Metropolis.

As in the States the current comes in as high tension three-phase and is converted to 100 volts D. C. The cinematographer can call on 14000 amps per stage, so it will be seen that there is no lack of juice. For outdoor sets there is practically unlimited space upon which to build.

A research department in charge of Leon Planskoi, who was with Rex Ingram on the M-G-M lot, both in Hollywood and at Nice, is doing good work, especially in determining, by spectroscopic and photometric tests, the various effective qualities of the different lighting systems in conjunction with the several negative stocks now upon the market.

The whole of the electric plant is under the charge of Mr. Stan. Double, an Englishman, than whom no better man could be found, and it would never surprise me to hear that the joint efforts of Mr. Double and Mr. Planskoi had evolved a new type of lighting altogether.

One lighting unit with which I was rather struck consisted of a center batten which held several incandescent globes, with either side mercury vapour tubes with the new fluorescent reflectors behind them, reflecting red rays, the whole unit being particularly suited to the use of panchromatic stock.

Elstree was the first attempt, in this country, to produce pictures on a really large scale, and today, two years after its inception, it is still the largest lot in the country. Judging by present appearances, with the amount of building going on, B. I. P. intend it to remain so.

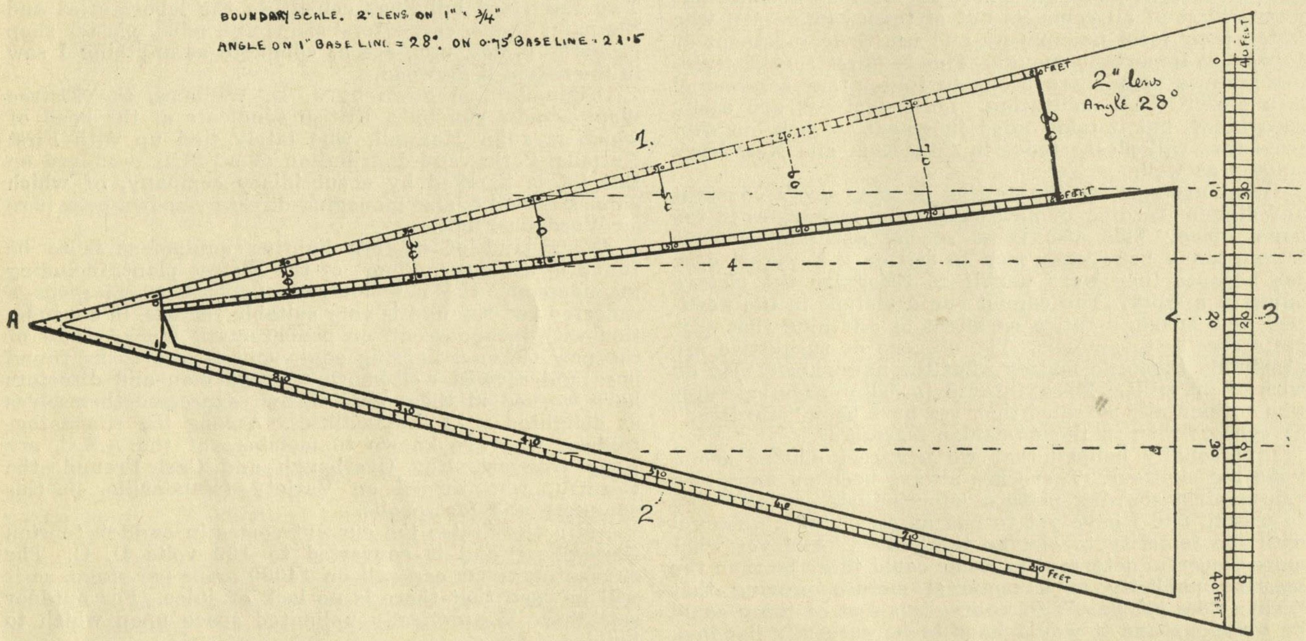
# A Boundary Scale for the Motion Picture Studio

By Dr. Alfred B. Hitchins,
Member of Society Motion Picture Engineers
F. R. P. S., F. R. M. S.

(Reprint by request from The American Cinematographer of June 1, 1922)

It is desirable to know how much of any particular set will be included in the field of view at any given distance and with any given lens. For instance, will the balcony high up in the set be cut off or properly included? Will the high, left-hand window be partially cut off or properly shown? Is the descending stairway placed so as to be properly included in the foreground?

It is true that these things can be determined by trial and error, but it has frequently happened that badly proportioned sets have been designed so that when the camera is placed at normal working distance important details were beyond the field of view. By moving back it would, of course, be possible to include more of the set, but then an out-of-proportion effect arises between the relative size of the players and their background. It is such an easy matter to determine before-hand how much of an existing set will be included or, when designing a new set, to create it with a knowledge of just where all important details should be built in so as to be properly included at normal taking distance with a lens of any particular focal length. The boundary scale illustrated in Fig. 1 is simply a practical amplification of the laws of triangulation which can be used without calculation. The size of the motion picture is 1″x¾″ and a 2″ lens calculated to the 1″ horizontal base line will embrace an angle of 28°; on the ¾″ vertical—an angle of 21.5°.




The scale illustrated is a combination of these two angles; a is the vertex of the angles. 1 and 2 represent the angle included on the 1″ horizontal base line and 4 and 2 represent the angle included on the ¾″ vertical line. 3, the side opposite the vertex, shows the width of set covered for any particular distance. It is only necessary to lay a straight edge from any distance on the scales 1 and 2 so as to follow straight through and cut the width scale "3" at the two sides, then subtract the amount ruled off on the two sides from the 40 ft. total scale.

| | View Embraced (Baseline and Vertical in Feet) at Various Distances. | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5′ | | 10′ | | 20′ | | 30′ | | 40′ | | 50′ | | 60′ | | 70′ | | 80′ | | Distance | Angle of View | |
| Focal Length in Inches | 1″ Base Line | 3/4″ Vertical Line | 1″ Base Line | 3/4″ Vertical Line | 1″ Base Line | 3/4″ Vertical Line | 1″ Base Line | 3/4″ Vertical Line | 1″ Base Line | 3/4″ Vertical Line | 1″ Base Line | 3/4″ Vertical Line | 1″ Base Line | 3/4″ Vertical Line | 1″ Base Line | 3/4″ Vertical Line | 1″ Base Line | 3/4″ Vertical Line | Ratio for Same Sized Image. | 1″ Base Line | 3/4″ Vertical Line |
| 1 5/8 | 3 | 2·3 | 6 | 4·6 | 12 | 9·2 | 18 | 13·8 | 24 | 18·4 | 30 | 23 | 36 | 27·6 | 42 | 32·2 | 48 | 36·8 | 1·00 | 34·5° | 26° |
| 2 | 2·5 | 1·87 | 5 | 3·75 | 10 | 7·5 | 15 | 11·25 | 20 | 15 | 25 | 18·75 | 30 | 22·5 | 35 | 26·25 | 40 | 30 | 1·35 | 28° | 21·5° |
| 3 | 1·66 | 1·25 | 3·33 | 2·50 | 6·66 | 5 | 10 | 7·5 | 13·4 | 10 | 16·66 | 12·5 | 20 | 15 | 23·33 | 17·5 | 26·66 | 20 | 2·00 | 19° | 14·5° |
| 6 | ·833 | ·625 | 1·66 | 1·25 | 3·33 | 2·5 | 5 | 3·75 | 6·7 | 5 | 8·33 | 6·25 | 10 | 7·5 | 11·66 | 8·75 | 13·33 | 10 | 4·00 | 10° | 7·5° |

Fig. 2

The remainder represents the width in feet of the set covered at the chosen distance.

Fig. 2 shows in tabular form the horizontal and vertical dimensions embraced by lenses of different focal lengths at distances varying from 5 feet to 80, also the camera or lens distance ratio for same size images with lenses of different focal length and the angles of view included with the different lenses.

It will be seen that 40 feet away with a 2-inch lens a set 20 feet wide x 15 feet high is included, and all these distances or intermediate distances can be read directly from the scale by ruling off with a straight edge as previously described.

Fig. 3 shows the application of the scale when designing a set. The horizontal boundary lines represent the angle of view included by a 2-inch lens on the horizontal base line of 1 inch. It is, of course, presumed that this line exists at the floor level. These lines are obtained from the outer scales of the rule. The dotted line marked "Vertical Boundary Lines" are plotted from a vertex point which is removed from the vertex of the horizontal boundary lines in proportion to the height of the lens from the ground. This probably will average 5 feet and the vertex is therefore plotted 5 scale divisions apart from the horizontal boundary line vertex. The angle included by these vertical boundary lines is obtained from the 4 and 2 scales of the rule and its point of origin is, of course, at the lens.

Now, if a straight line is drawn, equally dividing the horizontal boundary lines, this becomes the ground, or floor line, and where the lower vertical boundary line cuts, this is the point at which the floor first appears in the picture. Parallel with this ground line is drawn the ceiling line, and the separation of the two will depend upon the height of the studio, then the top vertical boundary line where it first cuts the ceiling line shows directly the available head room.

From such a diagram it can be calculated just what details of any particular set will be included at any distance from the lens. The scale is most conveniently made up so that ¼ of an inch on the scale divisions equals one foot and should be constructed of thin brass. A scale must be constructed for each lens of different focal length. The scale, of course, will not vary due to differences in focal length, but the outer and inner angles will change with the focal length. As the focal length increases the angle included will become less.

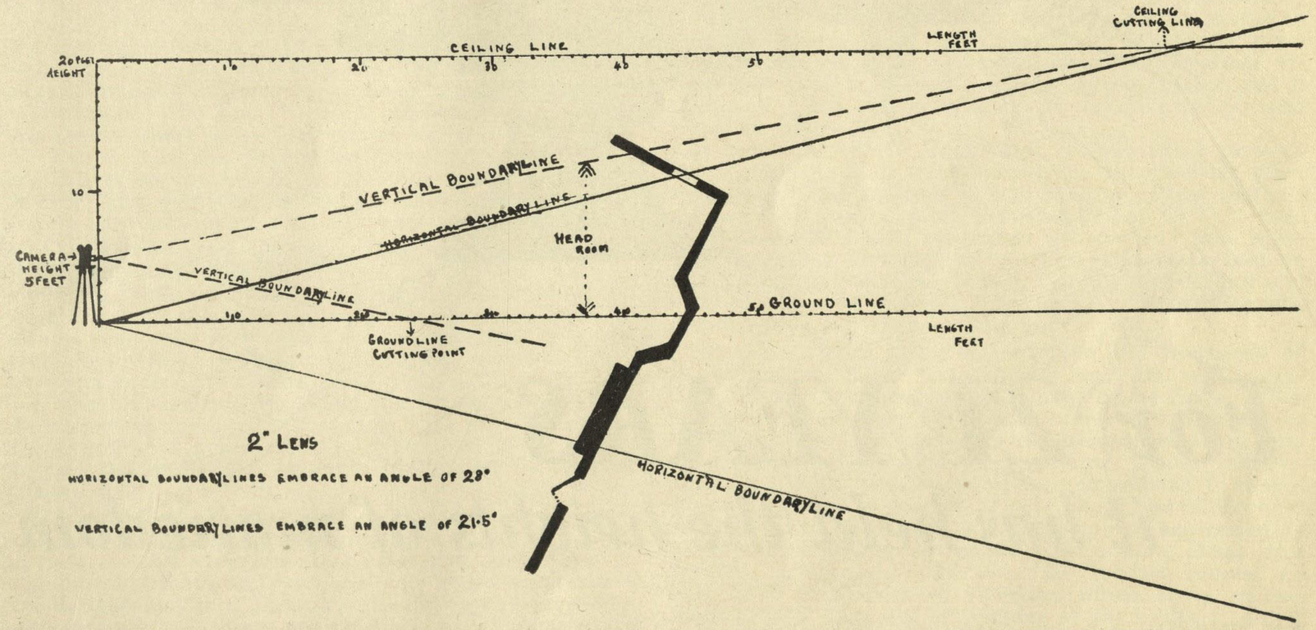



FIG. 3

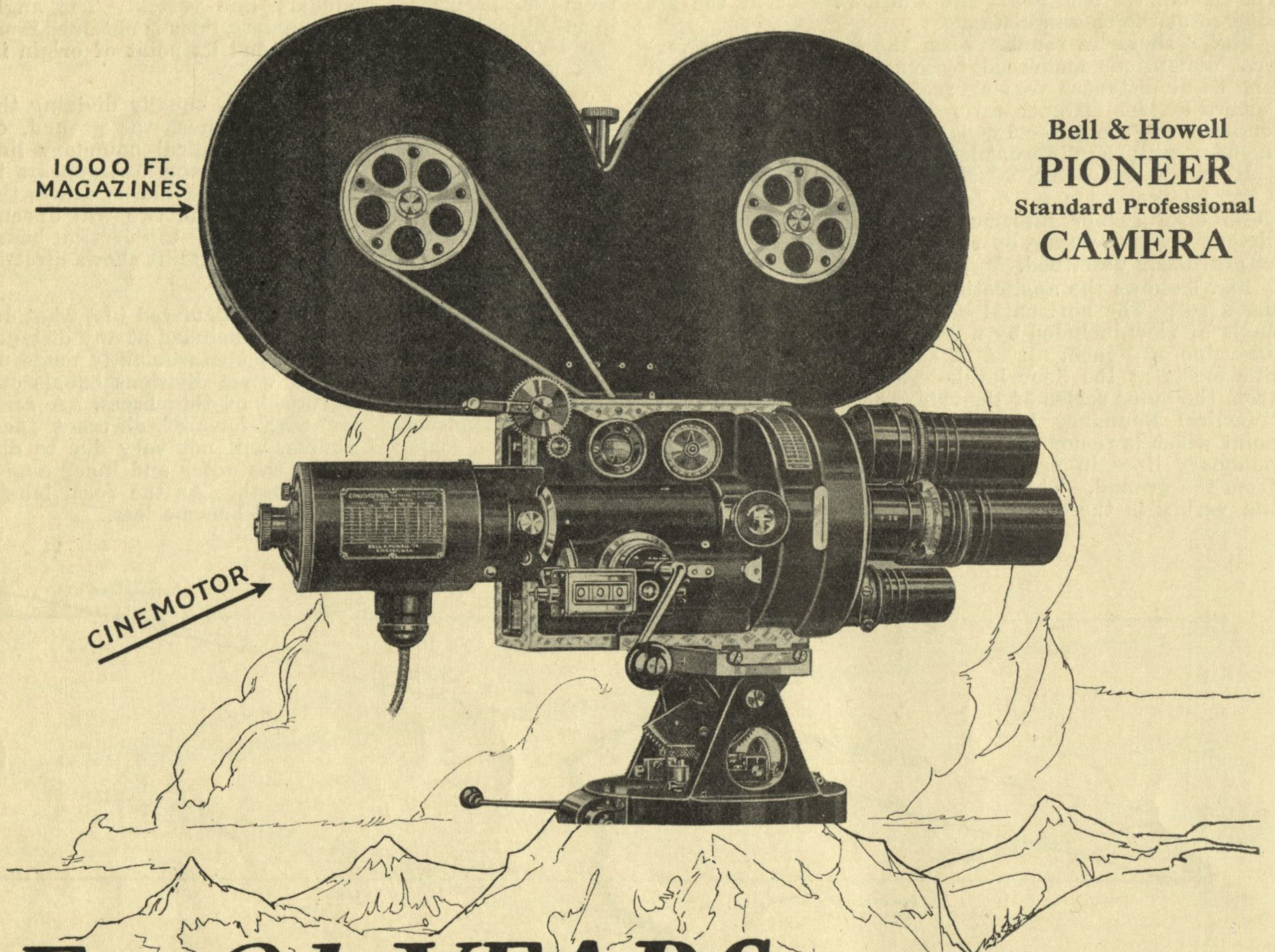
# A New Directory of Theatres

Herbert D. Seibert & Co., 126 Front Street, New York, have just published a book containing a complete list of theaters in the United States and Canada with the street address, seating capacity, film buyer, booker, purchasing agent, projectionist and telephone number. Besides this a great deal of other data is shown, such as admission price, sound equipment used, number of times a week program is changed and the like. This new publication of over a thousand pages also covers Chain Theaters, Discontinued Theaters, List of Supply Dealers, Producers, Film Exchanges and Film Boards of Trade.

It sells for $10 a year and is to be issued semi-annually.

# A $2,000,000 Film

Al Rockett, production and studio manager for First National Pictures, is in New York this week discussing plans for future production with Irving D. Rossheim, president; Ned Depinet, sales chief, and Mrs. Florence Strauss, head of the scenario department. Mr. Rockett left the West Coast for the East just after starting work on a series of sound stages at the Burbank studios. In his absence work on these stages is being rushed, with workmen busy twenty-four hours a day. While in the East Mr. Rockett will also complete plans for starting production on "The Miracle," the picturization of Max Reinhardt's great stage spectacle, which First National recently won the right to screen after a controversy with another production company. This picture is expected to cost around two million dollars, and will be the biggest and most spectacular ever attempted by First National.

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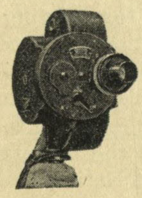

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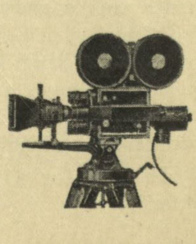

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# Acoustics Applied to Sound Recording --- Reproduction

By Vern O. Knudsen, Ph. D.
Associate Professor of Physics, University of California at Los Angeles

Read before the regular meeting of the Technicians' Branch of the Academy of Motion Picture Arts & Sciences, Thursday, September 13, 1928

Research, discovery and invention are the most basic factors in determining the course of industry. The present pandemonium in talking pictures had its origin in the discoveries of research laboratories. We hear a great deal about the responsibility of "The Jazz Singer" in ushering in the present era of sound pictures. This was a necessary but an inevitable step in the present development. However, long before "The Jazz Singer" was recorded the successful fruition of talking pictures was a certainty.

About three years ago there was published an account of some research on high quality recording and reproduction of speech and music. Those of us who were familiar with this work could foresee the not distant advent of talking pictures. We are now witnessing the inevitable sequel to those fundamental discoveries in sound recording and reproduction. At present, the sound developments are disturbing the very foundations of the motion picture industry. There is, however, little danger of a catastrophe. The present sonic upheaval probably will leave in its wake some destruction, but it also will open the way to new and diversified forms of entertainment and education, the like of which never have been experienced. The auditory, as well as the visual, sense has powers of appreciation and enjoyment. Throughout the ages, both sound and light have been united for purposes of expression and entertainment.

A little reflection seems to justify the assumption that the silent screen has developed to its present high state, without the help of sound, only because there were no adequate devices for uniting the auditory with the visual. However, recent developments in high quality reproduction of sound are now supplying the required devices for the successful union of the audible with the visible; and it is beyond the power of any of us, even if we would, to stop this inevitable progress in one of the world's greatest fields of activity.

This march of progress in the motion picture industry is, among other things, engaging all of the active and latent principles of sound, to the end that sounds can be reproduced without annoying distortions. To bring about this desired end it is necessary to have good recording rooms, good recording equipment, and theatres with proper acoustics.

I shall not speak tonight of the design of equipment for the recording and synchronizing of sound. You are probably already fairly well informed about such matters. I shall attempt rather to outline some of the fundamental facts and principles of the nature of hearing; some of the physical aspects of speech and music; the necessary conditions for good acoustics in interiors; and the necessary conditions for good recording and reproduction of sound.

In order to appreciate the problems with which the motion picture industry is now struggling, it is indispensable to know the elementary principles of sound and to be familiar with the nature of speech and music and hearing.

Sound has its origin in vibrating bodies. This gives rise to a wave-motion of a certain amplitude and frequency which spreads out from the source with a speed (in air) of about a fifth of a mile a second. When this wave-motion reaches the ear—provided the amplitude and frequency are within certain limits—there results a sensation of sound. If the wave-motion consists of a regular or periodic succession of vibrations, the sensation is that of a tone. Whenever the wave-motion consists of an irregular or a non-periodic succession of vibrations, there results a sensation of noise.

The physical wave-motion producing the sound sensation has three characteristic properties: amplitude, frequency and wave-form. The amplitude determines the loudness; the frequency determines pitch; and the wave-form determines the quality or timber of the sound sensation. Loudness and pitch are ordinal properties of amplitude and frequency, respectively. That is, as the amplitude increases the loudness increases; and as the frequency increases the pitch rises.

The relation of loudness to amplitude is not one of a simple direct proportion. For example, the increase in the amplitude of from 10 to 100 produces nearly the same increase in loudness sensation as the increase in the amplitude of from 100 to 1000. This gives rise to a so-called logarithmic relation between sensation and amplitude, and is the basis of expressing the loudness of a sound in the now-familiar transmission or sensation unit (T. U. or S. U.). The logarithmic relation between stimulus and response is characteristic of other sense organs. In fact, it is a basic law in psycho-physics, and it therefore plays an important rôle in all auditory and visual problems.

A somewhat similar logarithmic relation exists between the frequency of the wave-motion and the resulting pitch sensation. This relation is well known. Thus, there is the same interval of pitch between 32 and 64 d. v. (abbreviation for **double vibrations** per second) that there is between 512 and 1024 d. v. The ratio of the second to the first, in each case, is two, and the musical interval is the octave. In general, equal ratios of frequency correspond to equal intervals of pitch.

We have stated that the amplitude and frequency of the sound-producing wave-motion must lie within certain limits. It is of interest to know these limits. The normal ear can sense vibrations in the air which are so feeble as to produce a pressure variation in the air of only one-billionth of atmospheric pressure. These extraordinarily minute pressure variations correspond to movements of the air molecules of only about one-billionth of an inch. The loudest sounds the ear can accommodate have an amplitude of about one million times this amount. Expressed otherwise, the loudest sounds we hear have amplitudes of vibration which are a million times greater than the amplitudes of the feeblest sounds we can hear. This fact has a significant bearing on the problem of the recording and reproducing of sound. For example, the recording and reproducing apparatus must be capable of detecting and transmitting, without distortion, amplitudes of vibration which vary as much as a million-fold. This is a most severe requirement for any physical instrument. Again, these facts indicate the severity of the problem of providing sound-proof stages. It requires careful design and rather elaborate structures to prevent vibrations of so small a magnitude that they will not be detected by the ear or the microphone. Yet this condition is required for the best recording.

The frequency limits of sound also impose serious difficulties in sound recording. The range of frequency to which the ear responds is from 20 to 20,000 d. v. This embraces a range of ten octaves. This range appears quite remarkable when we consider that the eye responds to a single octave. Throughout the ten octaves which the ear appreciates, there is a wide range of sensitivity. The ear is most sensitive for frequencies between about 500 and 5000 d. v., and it becomes relatively insensitive to very low and very high frequencies. These facts also are significant in the design of both sound-recording equipment and sound stages.

A third property of sound is quality. The quality of sound is determined by the shape or wave-form of the vibration. If the sound is produced by the pendular vibrations of a tuning fork, a pure tone is produced. If a

musical note is produced by a vibrating string, the note is what we call rich in harmonics; that is, the note is made up of a harmonic series of simple harmonic vibrations. The harmonics result from the string vibrating in parts as well as in a whole, and they are responsible for the characteristic quality or tone-color of the musical note. For some complex sounds, it is possible to identify as many as forty harmonic vibrations, all blended together to produce the characteristic timber. These harmonics must all be faithfully recorded and reproduced to preserve the natural quality of the original sound.

Ordinary conversational speech consists of modulated tones and noises. In the production of speech, noises are produced by the larynx. These noises are modulated and altered by the resonant cavities of the throat, mouth and nose, and the stopping effects of the teeth, lips and tongue. Vowel sounds consist essentially of sustained vibrations. The vibrations first build up to a certain value, then are sustained for a short interval, and then diminish to inaudibility. The frequencies of vowel sounds embrace a range between about 100 and 4000 d. v. Consonants, on the other hand, are not sustained to any great length and they consist essentially of high frequency vibrations. For example, the "s" sound, the "th" sound and the "f" sound are made up essentially of vibrations above 2000 d. v. Some consonant sounds require frequencies as high as 7000 d. v. In general, for perfect recording and reproduction of speech, a frequency range of about 50 to 7000 d. v. is required.

Music requires even a greater range of frequencies—probably from about 30 to 10,000 d. v. In addition, the amplitude variation is often greater for music than it is for speech. These two factors, together with its greater complexity, contribute to the difficulty of faithful reproduction of music.

In order to give a more definite concept of the extremely minute amounts of energy contained in speech and music some simple calculations and comparisons have been made. Thus, all of the people in the United States would have to talk continuously for an hour and a half to generate enough heat to make a cup of coffee. Again, it requires 40,000,000 cornets blowing fortissimo to generate one horse power of sound energy. These remarkably small amounts of energy can be transmitted or stored or reproduced only by the most delicate and reliable devices.

We shall consider next the principal topic I wish to discuss with you; namely, the acoustics of interiors. Particular emphasis will be given to the acoustic design of sound stages. The conditions which must be satisfied for good hearing (or recording) in any interior are as follows:

1. The shape and size of the enclosure should be such as will provide adequate loudness of speech or music. In general, a small enclosure with reflecting surfaces near the source of the sound will give a louder and a more nearly uniform distribution throughout the room. The uniform distribution is greatly to be desired in the recording of sound, since this gives greater freedom in the movement of the source without the "fading" so familiar in current recordings. Reflected sound should be utilized to give a helpful reinforcement of the direct sound.

2. The walls and ceiling of the enclosure should be arranged and treated so as to eliminate every possibility of echoes. When direct and reflected sounds reach the ear, coming from the same sources but over sound paths which differ in length more than 66 feet, an echo is the result. It is necessary, therefore, to avoid large differences of paths of direct and reflected sound. If very large rooms are designed, all reflecting surfaces which may produce echoes should be well broken up. A curved surface may give troublesome echoes or interference, especially if the center of curvature be near the listeners or detectors. Such curved surfaces should be avoided.

3. Extraneous noises, whether of outside or inside origin, should be suitably reduced. Even a slight noise, such as may come from a ventilating fan or from remote outside traffic may impair hearing conditions. There are two principal methods of construction for the insulation of outside noise: (1) the use of heavy, non-yielding walls and partitions, and (2) the use of multiple layers separated by air-spaces. Both methods are in use, and both are effective. Precise quantitative tests are yet lacking to determine the most practical type of structure for sound stages. Data on various types of sound-proof stages are accumulating, and it is likely that within a year or two it will be possible to fix upon standard types of construction. All parts of the stage should be consistent with each other. Thus, if the ventilating equipment limits the insulation-value of a stage to 55 T. U. there is little need of going beyond this figure in the design of the walls and ceiling. It would seem advisable that the motion picture industry, through the Academy or some other agency, should institute a research program for the purpose of determining the most practical solution of this and other allied problems. Surely such a procedure would result in the common good. It would undoubtedly avoid vast expenditures for either inadequate or, in some instances, more-than-adequate types of building.

4. The most important factor in the acoustic design of interiors is the proper control of reverberation. At least 90% of the acoustic defects of auditoriums and sound stages are attributable to inadequate control of reverberation. In order to show the effect of reverberation upon the clearness of speech, some speech-articulation tests have been conducted in rooms having different times of reverberation. (The time of reverberation in a room is the time required for a sound to die away to one-millionth of its initial intensity after the source of the sound has been stopped.) These tests show that the distinctness of speech is improved as the time of reverberation is reduced, that is, as more and more absorptive material is added to the room. Thus, the hearing conditions in a room improved from 63% perfect to 93% perfect as the time of reverberation was reduced from 5.0 seconds to .60 second.

The optimal time of reverberation for an average sized auditorium, having a volume of 200,000 cubic feet, is about 1.50 seconds. For a smaller room the optimal time is nearer 1.0 second. Experience in radio-broadcasting and in the recording of sound has established somewhat lower times of reverberation for the best preservation of naturalness in reproduced sound. The optimal time of reverberation for recording rooms appears at the present to be about 30% less than the accepted time for auditoriums. Thus, it would seem that about .75 second is the proper time for a small studio having a volume of about 10,000 cubic feet, and that 1.00 second is the proper time for a large studio having a volume of 200,000 cubic feet.

The time of reverberation is usually referred to a tone of 512 d. v.; that is, the octave of middle C. It is necessary however to obtain a nearly uniform reverberation for tones of all pitch. This is not so easily accomplished because the usual sound-absorptive materials, which are used for reducing the reverberation in rooms, are much more absorptive for the high tones than for the low ones. Thus, most absorptive felts of an inch thickness are nearly five times more absorptive for high pitched tones than for low ones. This means that in a room treated with such material the time of reverberation for low tones is five times as long as the time for high tones. The result is an excessive emphasis and prolongation of all low pitched sound and an excessive damping and lack of resonance of the higher sounds. The bass notes of the horns and viols obliterate the higher and more delicate notes of the violin and piccolo. It is necessary therefore to use absorptive materials which are more uniformly absorptive for tones of all pitch. This calls for very thick absorptive materials, or for multiple layers of absorptive material separated by air-spaces. Materials and compositions of materials are being developed to meet this important need.

In general, music requires a somewhat more reverberant space than speech does. It is desirable therefore to make provision for altering, to a small extent, the reverberation of the space in which the recording is done. This can be accomplished fairly satisfactorily by the use of suitable absorptive and reflective materials for the set and flats, but for the best acoustic conditions the entire stage must be appropriately adjusted.

We have discussed primarily the acoustic requirements of the sound stage for high quality recording. It is, of course, equally important that the recording equipment and the theater in which the sound is reproduced be properly designed for the preservation of the naturalness of the reproduced sound. The equipment must be free from two distinct types of distortion: (1) "frequency"

# Marshall's Electric Flare

The John G. Marshall Company, of Brooklyn, New York, have just announced their electric fire-control system for the ignition of flares and are supplying flares for use with this system. This Company has been manufacturing match ignited flares for many years.

On the new Electric Flare a squib is embedded in the flare head and two wires project which are to be connected to the electric firing circuit. When the firing switch is closed the flare instantly bursts forth into full brilliancy without waiting for the fuse and first fire to burn. Each flare requires only 1½ volts which may be secured from a single cell of a vest pocket flashlight battery measuring only ⅝ inches in diameter by 2 inches high.

Several flares may be ignited simultaneously by connecting them in series—as many as fifteen may be fired by a 22½-volt radio dry battery measuring only 2½x4x3 inches and weighing less than two pounds.

The fire control is operated by the cinematographer who simply closes the switch the instant he desires the flares to start.

While at first thought series connections might be condemned because of the theoretical liability of some flares to start a fraction of a second before the others and thus interrupt the circuit, actual practice indicates that this does not occur, and that they all start simultaneously unless an old run-down, dry battery is used. With series connections the wiring is simplified and a galvanometer test of the circuit may be made before firing.

The John G. Marshall manufacture the flares only, but the auxiliary equipment is easily obtained in any radio or hardware store and full information concerning batteries, etc., will be given by the manufacturers of the flares. Five lengths of flares are available; ½, 1, 2, 3, 4 minutes each.

The flares are distributed at three main points; Edward H. Kemp of San Francisco, Bell & Howell of Chicago and John G. Marshall of Brooklyn.

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Al Rockett has signed a new two-year contract with First National Pictures, giving him complete charge of all production and studio activities at the big Burbank plant until December, 1930. Mr. Rockett has been production manager at the studio for more than a year, and recently assumed the added duties of studio management as well.

"We have sixty-one pictures scheduled for release between now and the last of August, 1929," Rockett said. "All but two of these are to be made at Burbank, and these two are foreign productions. This means that the studio will be busier than at any time in its history. About thirty of our pictures for the year will be sound pictures, and we are now building sound stages at the studio, so that the synchronization may be done here.

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distortion, that is, the equipment must amplify equally all frequency components of sound; and (2) "non-linear" distortion, that is, the reproduced sound should be free from all frequency components which are not in the original sound. This latter type of distortion results from the magnetic properties of transformer cores, from the vibrating diaphragm in the microphone, and from the vacuum tubes in the amplifier. Distortion from these sources must be minimized or compensated by corrective circuits.

The acoustics of the room in which the sound is reproduced is extremely important, but is rarely satisfactory in existing theaters. The requirements for good hearing in auditoriums, as set forth in an earlier part of this paper, should be incorporated in all theaters.

All of the foregoing acoustic requirements are pertinent to high quality recording and reproduction of sound. The novelty of synchronized sound and "talkies" will not last long unless the quality of the reproduced sound be improved. Patrons will become increasingly critical of the lack of naturalness of the present quality of reproduced sound. The success and permanence of the union of the auditory with the visual in motion pictures will depend in a large measure upon the degree of improvement in the naturalness of the reproduced sound.

# Movie Museum at U. S. C.

(Contributed)

Despite the fact that the motion picture industry has made such tremendous advancement during the past few years until it is now the third largest industry in this country, with several hundred million dollars invested in it both directly and indirectly, producers almost without exception failed to recognize that the old haphazard hit-or-miss methods of former days must be as completely discarded as the antiquated appliances used in production a decade since, and that the dictators of the future (whether connected with the executive, technical, literary or acting branches of the industry) must have received a course of scientific and practical training similar to that required of the man or woman who has selected medicine, engineering, law or teaching, as his or her profession.

The first step taken towards the correlation of the work at the university and of the studio was when, some two years since, two or three of the leading studios requested certain universities to select a limited number of young men and young women who were willing to take a short course of practical training at their studios, paying these students satisfactory salaries during such training and guaranteeing them positions at the end of the course, if they proved efficient.

This scheme proving an unqualified success the Board of Directors of the Academy of Motion Picture Arts & Sciences approached the Trustees of the University of Southern California with a view to the correlation of the work of these two important bodies, so far as the motion picture industry was concerned.

Their proposals were, after due consideration, favorably entertained and, in September, 1927, the University authorities drafted a special curriculum spread over a period of four years for those students desirous of graduating with a degree associated with such special training.

It was something more than a coincidence that just as this new scheme was being launched the authorities learned that Professor J. Tarbotton Armstrong, the possessor of probably the finest research library in California, an antiquarian and collector of over forty years standing, and a recognized authority in matters pertaining to art generally and motion pictures in particular, was willing to place not only his library and art treasures, but his accumulated knowledge and experience at their disposal.

Such an offer at such a time was far too acceptable to be lightly regarded and Professor Armstrong's offer was promptly accepted with the understanding that the articles thus donated were to form the nucleus of a museum devoted primarily to the use of students taking up the course previously referred to, but also accessible to the general public, and professor Armstrong was forthwith installed as Director of the Museum.

This nucleus is to be supplemented by collections of appliances, costumes, models, sketches, settings, scripts, obsolete films and other accessories of the industry as may possess an historic value, many such articles having been already promised by leaders in the industry, while funds are being raised and plans are under consideration for the erection of a special building suitable for the housing of so important and so valuable a collection.

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Five units for the production of sound pictures will be constructed at First National Studios in Burbank, according to the estimate prepared, the building program calling for an expenditure of half a million dollars. Each unit is to consist of four stages, five buildings and a recording building, all of uniform dimensions. Half of the first unit will be completed before work starts upon the others. One stage will be ready for sound effects on "The Barker," and another for "Changeling," both George Fitzmaurice productions. There are thirty sound pictures on the year's program. The builders are Schofield and Twaits and the recording equipment is that of the Electrical Research Products Company. The first unit is under way, the contractors working twenty-four hours a day.

# *Measuring the Quality of Sound Reproduction*

*By* J. B. Engl
Technische, Hochschule, Berlin, Germany

This paper was presented at the Fall Meeting of the Society of Motion Picture Engineers, Lake Placid, N. Y., September 24-28, 1928.

1—A. O. Rankine Proceedings of the Physical Society, London, Vol. 32, P. 78.

The technique of recording and reproducing sound for the purposes of "sound-picture films" has created a new problem for testing the quality of the reproduced sound. A very natural method of testing the quality is, of course, just hearing the reproduction and comparing it with the original speech or music, if you remember it. But it is known very well that the human memory and our ears are not very reliable. Asking different hearers in the audience, shows you almost as many opinions as there are hearers. I wish to remind you here of what A. O. Rankine, in a paper on sound recording, said about the small effect of changing the density of records, pitch and fineness of picking up the light-line, on the clearness of reproduction. He thinks "only a rough approximation to the original vibrations are necessary in the reproduction of sound in ordinary listening."

Now we certainly will not be satisfied with a reproduction of "talking moving pictures" of that kind. We wish the characteristics of the reproduction to be exactly the same as the original if possible. Hence we need an impartial method of measuring the quality, which does not depend on different opinions in the audience, at least to be sure that our apparatus meets this standard.

The method, I propose here to use, is an indirect one, inasmuch as I test the different parts of the reproducing outfit separately and expect then the result of the combination to be an excellent one. The whole method is, of course, based on a laboratory investigation and has to be carried through by a sound-engineer.

A reproducing outfit consists of a picking-up device, for instance, a photo-electric cell acted on by light-rays, an amplifier, and loudspeakers. Let us begin with the amplifier. It is easy to generate alternating voltage of different frequencies in the range of 16 cycles to 10.000 cycles per second, by means of one or several suitable alternating current generators. The voltage can be measured with the usual type of a. c. volt meter. A small definite fraction of this voltage is applied by means of a potentiometer arangement to the input circuit of the amplifier. The inductance and capacity of the potentiometer resistances must be negligible. The output circuit of the amplifier is connected to an oscillograph of the bifilar loop type. The amplitude of the oscillating loop is kept constant for different frequencies and the necessary potentiometer-positions to obtain that are noted. These positions should be the same for all frequencies for a reliable and suitably designed amplifier. Oscillographs with a constant sensitivity up to 10.000 cycles are on the market.

When we know that the amplifier has a constant frequency-characteristic, we can go on with testing the loudspeakers. Without requiring too much scientific work, that can only be done when testing the recording microphone. To be able to carry through this test, we need two separate sound-generators of small size. These can be easily built on the principle of heterodyning two oscillating valves, rectifying the beat-note and applying the audio-frequency to a telephone or small loudspeaker of any type. For each frequency to be tested we make the sound-intensity of the two generators equal by small adjustments of the currents in the generators. One generator is then put at a definite distance from the microphone, the other at a definite distance from the loudspeaker unit to be tested. Of course, microphone and loudspeaker unit have to be in acoustically separate rooms. The best place for the microphone will be the open air. The output of the amplifier is cut down by an ohmic potentiometer device, to a point that we get equal intensity from the second generator and the loudspeaker unit. By hearing alternately the generator and loud-

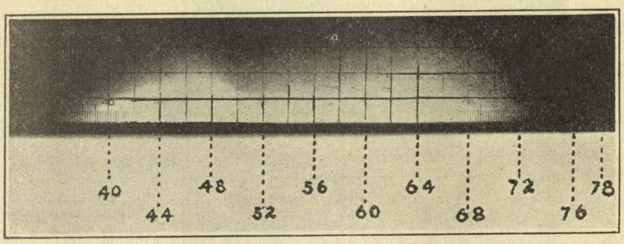
(*Concluded on Page 21*)

# The Technical Editor's Page - - By J. A. Dubray

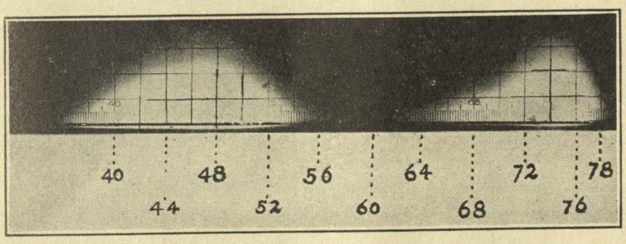
The Du Pont Company has recently introduced to the motion picture world a new raw negative stock which is marketed under the name of Infra-Red D.

Information on this film has reached this office almost at the time of going to press and therefore this article is necessarily brief and the information rather incomplete.

The two spectrograms reproduced in the article show the interesting characteristics of the new film as compared with the Du Pont Panchromatic.




Du Pont Panchromatic




Du Pont Infra Red D

The sensitiveness of the infra red stock extends to wave-length 780 millimicrons and presents two marked peaks, one at 460 and one at 740, with a wide trough between approximately 560 and 620. millimicrons.

It is quite evident that the use of any filter which absorbs radiations up to 560, such as the orange and red Wratten filters from No. 22 to 29 as well as from No. 70 to 73, will let only rays of the Red and extreme Red region to concur to the formation of the photographic image. The choice of the filter depends, of course, upon the amount of chromatic distortion desired and consequently upon the special effect wanted.

The most apparent use to which this film will be put in motion pictures production is for the obtention of night effect in full daylight.

The H and D curves illustrated show the characteristics of the film.

The exposure from which the curves have been determined were made alternatively to White and Red light.

White light was obtained with an unscreened incandescent lamp burning at about 1900 degrees centigrades corresponding to 2173 Kelvin. The Red exposure was made with a similar lamp burning at about 1850 degrees centigrade (2223 Kelvin) behind an A filter.

At first approximation the slope of the straight portion of the curves indicate differences in contrast from a Gamma of 0.96 for the White light characteristic to a Gamma of 1.75 for the Red light characteristic, the increase in contrast of the latter being interesting in regards to the particular use to which the film is to be put in cinematographic work.

The values of the inertia for the two curves are, also at first approximation, about 0.312 for the Red and 0.063 for the White light characteristics, their ratio being nearly 5.

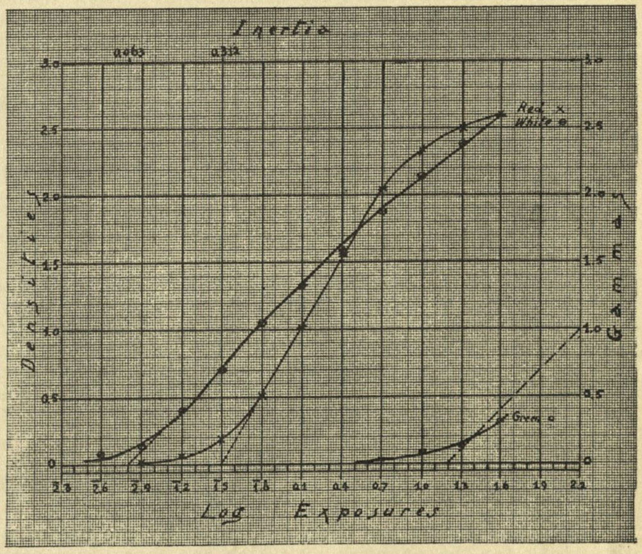
More precise data in this respect will be given in the next month issue of the AMERICAN CINEMATOGRAPHER.

The Green characteristic is interesting in the respect that the Green filter used for the determination of the curve is **"definitely tied up with the green safelights used at the Du Pont laboratories"** as literally expressed by the communication. This curve establishes therefore the degree of precautions which have to be taken in the manipulation of this film during the loading of the camera magazine and the processing.

The keeping quality of the film as reported by the Du Pont Company is of great interest, as it appears that the film does not deteriorate any more rapidly than the Du Pont Panchromatic, and therefore extraordinary precautions are unnecessary in this respect.

As previously stated, this brief article is rather incomplete, and we find our excuse in the desire to bring immediately to the cognizance of the cinematographic world this new product.

Extensive practical tests are being conducted at the present time, and we hope to give further information on this matter in our next issue.

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Mr. C. W. Handley, of the National Carbon Co., brings to the attention of the Research and Educational Committee of the American Society of Cinematographers the results of an investigation recently carried on by the development laboratory of that company on the means by which the reflecting surface of the arc lighting equipment used in motion picture production can be improved.

This improvement which has to do only with the so-called floor lighting units and scoops consists of a reflector, the curvatures of whose surfaces have been computed and designed so as to bring the rays of the twin carbons to an angle of emission which increases the efficiency of the lamp over 100 per cent when compared with the intensity of the light reflected by the units in use at the present time.

The shape of the reflecting surface is such that the beam of light at its emergence from the lamp subtends an angle of approximately 60 degrees which angle has been proven theoretically and practically to be the most efficient for studio use.

Although the National Carbon Co. is not engaged in the manufacturing of any lighting equipment exclusive of carbons it has constantly interested itself in investigating the means by which studio lightings can be improved in both the artistic and the economic fields.

This latest contribution is being submitted to extensive tests at the present time, and THE AMERICAN CINEMATOGRAPHER will report on the results obtained in the near future.

# The General Elec

## *Description of the Pr*
## *Developed by the W*

*By* H. B.
Trans. S. M. P. E., 11

It is the purpose of this paper to present a brief sketch of a method of recording and reproducing sounds to accompany the action of motion pictures and to demonstrate one form of the results.

From the crude devices of thirty years ago have grown a highly developed art and a large industry relating to motion pictures. The combination of this art with a new one, that of simultaneous reproduction of sounds, requires for satisfaction a similar degree of development in the latter. Although perfection is not claimed yet, it is believed that the system to be described has improved the quality of the sound to the point where its use in combination with the older art results in improved entertainment.

The chief requirements of a good system combining sound and pictures are: First synchronism between sound and picture; and second, distortionless recording and reproducing; that is, a high degree of faithfulness of sound both in loudness and quality.

Lack of synchronism may be caused by differences of speed of sound and picture either in the recording or reproducing process. Differences between original and reproduced sounds, called distortion, may be caused by mechanical, optical, photographic, electrical, or acoustical characteristics of the system.

Of the mechanical requirements of good reproduction, one of the most important is the ability of the machinery to move the film past the sound record aperture at uniform speed since pulsations in film speed due to non-uniform motion of gears, sprockets, etc., may result in bad reproduction. Weaving, curling, scratches, and dirt spots are other causes of mechanical distortion.

The effects of optical devices on the quality have been studied and a design obtained which is free from all except inherent limitations; namely, those arising from the fact that an infinitely narrow slit is not attainable.

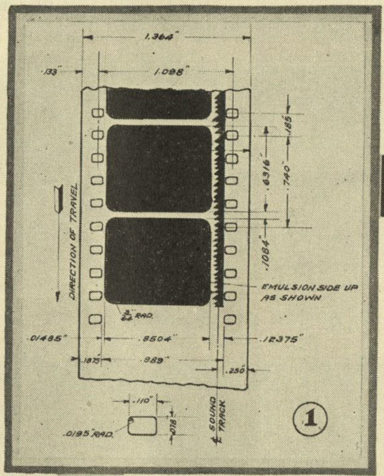
Graininess of film has been minimized by the use of positive stock for the negative on which the sound is recorded. Errors due to wrong exposure and development are small with this system because the results desired are constant density, minimum fog, and sharp edges. A density of 1.3 and development to unity gamma are aimed at, but these values are not critical. The uniformity of film speed during printing of the sound is as important as in the other processes, and no creeping or slipping is allowable.

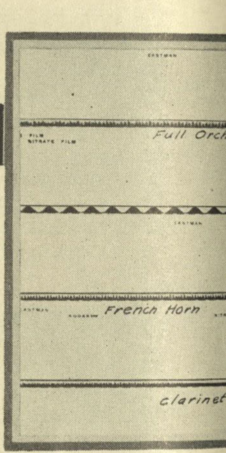
Electrical distortion may be caused by failure of photoelectric devices to convert accurately the variations of light into electrical current; by failure of the amplifier to perform properly; and by lack of steadiness of the power supply.

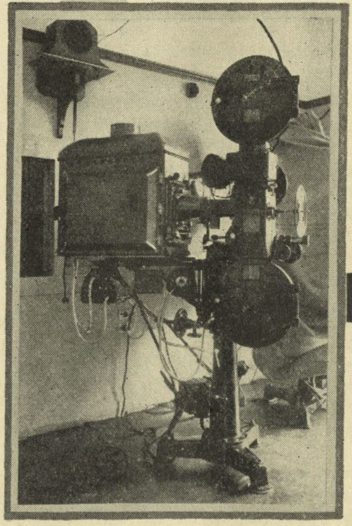
The experience of the General Electric Company in the development of high quality loud-speakers has been utilized and it is believed that the present form represents the best obtainable at the present time. Reverberation in the room in which the sound is reproduced may, of course, affect the results and should be treated in each individual installation.

Another form of disturbance, while it is not properly called distortion, should be mentioned. This is the presence of extraneous noises, such as sprocket hum, mechanical vibration noises, radio interference, etc.

The major points in the problem of development of the system have been outlined. No attempt will be made here to discuss in detail the solution of the above problems. A fairly comprehensive knowledge of the characteristics of the process has been obtained in the laboratory and steady progress is being made toward the complete elimination of the faults. Thus the thirty years handicap confronting those who are working on the addition of sounds to the motion picture is being overcome.



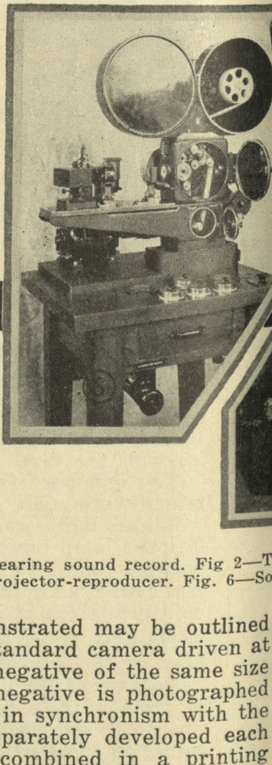


Fig. 1—Dimensions of film print bearing sound record. Fig 2—T
4—Loud speaker group. Fig. 5—Projector-reproducer. Fig. 6—So

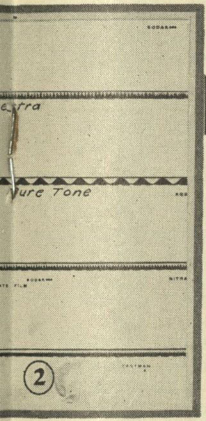
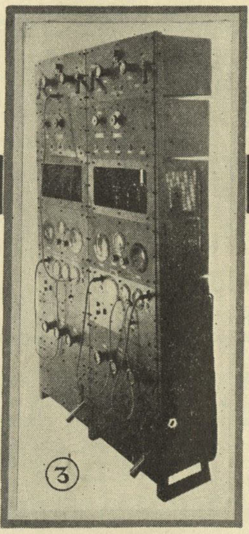
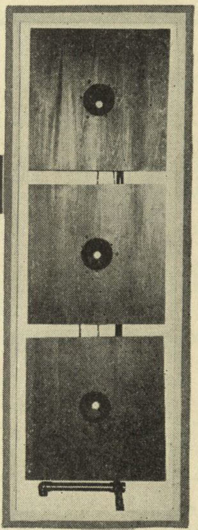
The system which is to be demonstrated may be outlined as follows: Pictures made with a standard camera driven at constant speed result in a picture negative of the same size as in the present art. The sound negative is photographed on a separate positive film moving in synchronism with the camera film. The two films are separately developed each to its own proper density, then combined in a printing machine to produce a combination print on a single film. The shape of the picture positive is maintained but the size is made slightly smaller to accommodate the sound record. The reproduction on the screen is of the standard shape, the sound recording being masked in the projector. Dimensions of picture and sound record in the print are shown in Fig. 1. The problem of synchronism has been solved by the use of synchronous motors both in recording and reproduction.

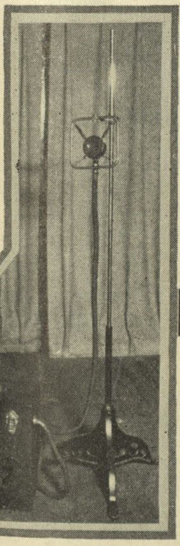
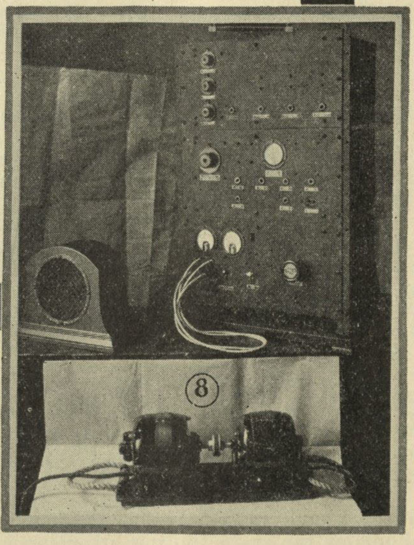
There are two types of sound records in use. One is

# tric Sound System

## oducing Apparatus as izards of Schenectady

Marvin
No. 31, 475 (1928)

ypical sound records. Fig. 3—200-watt amplifiers in duplicate. Fig.
und recorder. Fig. 7—Sound collector. Fig. 8—Recording amplifier.

known as "variable density—constant area" and the other as "constant density—variable area." A theoretical treatment of the two types has been given by A. C. Hardy[1] in a previous paper. In that paper it is shown that there are certain advantages in the variable area system which are likely to result in better reproduction with greater allowable deviations in exposure and development. This type of sound record is therefore used in our system. Examples are shown in Fig. 2 of sound records of pure tones, clarinet, French horn, and full orchestra. The recording and reproducing speed is 90 feet per minute. The picture and sound are printed about 15 inches apart with the sound above the picture as seen in the projector. Sound is recorded through an optically imaged slit 0.001 inch by 0.100 inch and is reproduced by means of an optically imaged slit 0.001 inch by 0.110 inch, although narrower slits have been used.

Conversion from light pulsations to electrical current is accomplished by means of a gas-filled photo-electric cell having a caesium cathode. The reproducing light is obtained from a 50-watt, concentrated filament Mazda C lamp located on the projector. This light passing through the film, on which the blackened area is proportional to the sound, causes pulsations of current in the photo-electric cell. The alternating component of this current is then carried to the amplifier.

The power is amplified and controlled to the value necessary to operate the loud-speakers. The size of amplifier depends upon the class of service for which it is intended. The largest amplifier is capable of delivering 200 watts of undistorted power to the loud-speakers, which is believed to be sufficient for the largest theater. The smallest size is intended to operate a single type 104 R.C.A. loud-speaker.

The loud-speakers are the moving cone type used in groups and assembled with baffles to increase the efficiency of sound radiation. The number of loud-speaker units ranges from one to twelve depending upon the size of installation. Each unit may be adjusted in horizontal or vertical directions so as to produce uniform distribution of sound throughout the theater. Power supply for the amplifiers and for the fields of the loud-speakers is obtained from a motor generator set, the starting and adjustment being controlled at the amplifier. Amplifiers are supplied wholly or partly in duplicate for emergency operation. Two types of reproducers have been developed. One has an attachment for the Simplex projector inserted between the upper magazine and the projector head. A constant speed motor is substituted for the variable speed mechanism of the standard projector. The other is a complete projector in which sound and picture mechanisms are contained within a single housing. Either of these arrangements may be run at constant speed for sound and picture or at variable speed for picture only.

The apparatus used in the recording process consists of camera, sound recorder, amplifier, sound collector, and the necessary power supply devices. Standard cameras are used except that a synchronous motor is substituted for the hand crank or the variable speed motor and a device is added to mark on the film the starting and stopping points. The sound recorder is substantially built to operate with little vibration and uniform speed. It is also driven by a synchronous motor. The film is carried over a drum with loops between the drum and sprockets. This has proved to be a desirable means of eliminating mechanical distortion caused by sprocket teeth and gears. A small photometer is used to check the exposure. The optical system is somewhat similar to that used in the reproducing device; namely, concentrated filament lamp and system of lenses to produce an image of a slit on the film. The variation of exposed area on the film is obtained by means of an electromagnetic galvanometer similar to that used in oscillographs. The moving system comprising a current-carrying strip and a small mirror is so designed that the response is practically uniform from zero to 6000 cycles. This covers the useful range in speech and music. The sound collectors are of the type known as condenser microphones and may be used either singly or in groups. Each microphone is connected to its own two stage amplifier after which all are connected to a power amplifier adapted to control the volume of each collector separately and also the volume after combining. The power amplifier may be located near the sound recorder and is equipped with a monitor loud-speaker. Power for the amplifier and the recorder is supplied by a storage battery and a small motor generator set. Recorder and power amplifier are preferably located in a separate

room or in outside work on a truck. Only the sound collectors and the cameras need to be at the scene of the picture.

The usefulness of the combination of sound and picture is beginning to be felt. One application is to action and sound of scenes in which both originate and are recorded at the same time. The sound may be speech, music, or noises which are intended to enhance the effect of realism. In this field a new technique and a new art remain to be developed and it, therefore, excites the greatest interest in experimentally minded persons.

The reproduction of music to accompany a picture is a quite different field in which the sound recording may be done either at the time of the action or later. Both methods are feasible and each has its advantages. The method in which music is recorded after the final form of the picture has been decided upon seems on the whole to be preferable. The highest quality of reproduction is essential in this application, for its primary purpose is to provide better music in locations where the best is not already available. This principle has been kept constantly in mind during the development of the present system.

A third application is the reproduction from film to stage sound effects where the primary object is accurate timing and dramatic effects, and the primary requirements are synchronism and adequate volume of sound.

Examples of motion pictures with sound have been obtained in all three fields of application. The fidelity of reproduction can now be said to be fairly satisfactory; for example, speech has been recorded which is scarcely distinguishable from the original voice. The same is true with instrumental music. Reproduction of explosive sounds has not yet reached the same degree of development. These are probably the hardest sounds to reproduce. It has been found feasible to transmit music and voice currents distances up to 200 miles over telephone lines and record with satisfactory results. The recording and reproduction of stage sound effects has proved practical as evidenced by the film "Wings," although in this case the sound and picture prints are on separate films.

The demonstration which follows is an example of the recording of music to accompany a motion picture. The recording was done at a later time and in a different place from the photography. It will be observed that in a few scenes there are opportunities for simultaneous recording of sound occurring during the action which leads to the conclusion that probably the combination of accompanying music with incidental sound effects will be desirable.

## *DeVry School Films, Inc.*

University and city centers of film distribution are showing great interest in the DeVry series of school films. Last month the University of Kansas, through its Bureau of Visual Instruction, sent out a new bulletin to the schools of the state, calling attention to the efficiency of the new 16 mm. projectors and films.

The bulletin announced among others that it was prepared to furnish the complete 86 courses of DeVry School Films, Inc., in 16 mm. widths and published all the titles of the series. The University has arranged a very liberal rental system to the schools of the state.

A greatly improved system of distribution has been worked out, by virtue of which DeVry dealers all over the United States will carry these libraries on a basis which will permit schools either to purchase or rent the films and save both time and money in deliveries.

The Chicago and New York offices, however, will take care of any orders from localities in which dealers have not stocked the films.

Paul Perry, A.S.C., is shooting "Desert Love" for Director Geo. Melford, who recently produced "The Sheik." They are working at F.B.O.

## Measuring the Quality of Sound Reproduction

(*Continued from Page 16*)

speaker, we can get as accurate a result as the sensibility of our ears permits, i. e., an accuracy of about 20%. This is done for all frequencies desired. The fraction to which the potentiometer must cut down the output energy of the amplifier will be the same, if both microphone and loudspeaker unit transmit all frequencies in the same way.

There remains the testing of the photo-electric pick-up device. In order to do that we must generate a light tray of effectively constant intensity, but modulated by frequencies of the range spoken above. For the lower frequencies up to 60 cycles that is done by passing a constant light beam from a tungsten filament through a polarizing and analyzing Nicol. The polarizing Nicol is revolving with different constant velocities, as it is mounted suitably and driven by a motor. The light impinges on the photo-electric cell, connected to the amplifier. The output of the amplifier is connected to the oscillograph used for amplifier testing. Again the amplitude of the oscillograph loop should remain the same for all frequencies. For the higher range up to 10.000 cycles, there is inserted between the two Nicols a Kerr cell. This device, as I do not need to explain, is used for modulating light for television purposes. The two Nicols are set at polarizing angles of 45 degrees to the condensor plates of the Kerr cell. By applying a constant alternating voltage of any frequency to the condensor plates, the lightrays are modulated with the desired frequency.

In this way we are able to test all parts of the reproducing apparatus, and we know now that with such tested apparatus density variations of any frequency in the range of audibility will be reproduced faithfully and without distortion. In each case of testing we can make actual oscillograms with increasing amplitude and determine the volume which gives distortionless reproduction for different frequencies.

It seems to me that tests of the described kind should be undertaken for the different existing systems of sound-film reproduction. I have started with investigations of this kind at the German "physikalisch-technische Reichsanstalt" and hope to be able to give you the detailed results at the next meeting.

I think there can be no doubt that this method gives more dependable results than individual opinions of any one in the audience, and that in this way we will avoid expensive and unnecessary work and experiments and finally get the best picture-sound reproduction possible.

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Mr. Peter Mole, Lighting Engineer of Hollywood, is attending the Lake Placid meeting of the Society of Motion Picture Engineers. While at the convention Mr. Mole will represent the Technicians' Branch of the Academy of Motion Picture Arts and Sciences, of which he is also a member. During this eastern trip he will study conditions in the New York motion picture district and visit the General Electric Company at Schenectady, N. Y., the Lamp Laboratories of the National Electric Light Association at Cleveland, Ohio, and the Edison Lamp Works at Harrison, New Jersey.

**Peter Mole**

# *Photography Among the Fine Arts*

*By* LEWIS W. PHYSIOC—Part Two

First of all, let us consider its origin. It began with Louis Daguerre's passion for representing the beautiful that aroused his desire to fix the image of the camera-obscura, and whether it was discovered by accident or persistent experimentation matters not; the idea was conceived in an artist's heart.

Simplifying our definition we have: that which is produced by man, using natural forces to create what nature, itself, does produce.

We immediately form a distinction between the arts and establish a group we term the Fine Arts. This group, as we have seen, is so peculiar as to demand an individual definition and since it challenges the classification of another one of the arts we set them forth in comparative columns.

**Fine Arts**

Such productions of human skill or genius, more immediately addressed to the taste or the imagination.

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Fine Art admits that it is founded on the principles of science and technique, but claims that the manipulation of these agencies requires a peculiar endowment to produce artistic excellence.

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Fine Art claims to embrace the elements of sublimity, beauty, grace, picturesqueness, proportion, order and fitness and that the love of these constitutes the soul of an artist.

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The artist claims that his medium permits of idealization commensurate with his talent, and that this idealization is the spiritual and ennobling force in art.

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Fine Art admits that the technical elements of art in hands of the unendowed produce anything but works of art.

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Fine Art claims the realms of fantastic imagery.

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It has been said that the artists' standard is nature. This is not true. His standard is **feeling**, his object the ideal. Nature may suggest his subject but only so far as it agrees with his taste.

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Fine Art claims such individuality that its exponents, in all ages, have been recognized more by their work than by their signature.

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The painter claims a greater scope in design and compositions; altering the forms of nature to meet the requirements of taste.

**Photography**

Since Photography is an imitative art, as is painting, it should justly claim a place under this definition.

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Photography is founded on science so sublime in its nature that the mastery of it excites the same emotions as the other fine arts.

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It is also the love of these elements that directs the photographer to select this medium of expression.

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The photographic technique is so elastic that individual taste is allowed a tremendous scope for idealizing.

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Photography admits of the "kodak fiend," but even as a hobby, photography inspires a love and enthusiasm that might well be called an artistic impulse.

It is true that photography is limited to representing the purely natural, but this medium has such technical possibilities that moods are exhibited and effects achieved that excite the imagination almost to the extent of fantastic figures.

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This is true, but nature, in itself, is often sufficiently beautiful to offer to photography worthy subjects, and when treated with certain individual skill and the technical expedients the medium provides, the results are frequently an idealism that inspires a reverence as works of art.

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This is equally true of photographers. Some of them have developed such a degree of individuality that their works are easily recognized—by their composition, lighting technique, etc.

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The photographer may develop a very refined sense for composition because his medium demands a selective ability that develops a very critical understanding of composition.

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We may further generalize and find many interesting analogies that seem to place photography, indisputably, in the category of Fine Arts. We have often heard it said that the first thought of the artist should be to please. This appears to be more the commercial idea, but art being an appeal to the taste should disapprove of this, for that which may please one may not suit another. Such work strongly smacks of the "pot-boiler." An artist's design should be independent of any influence; it is, more likely that something fomenting within him; there are certain things he has got to do. Such expression may not please everyone, but if he does it to his own satisfaction there will surely be other kindred spirits to whom his work will appeal. The same is true of the photographer. He may carry his pack for days and not see a subject that appeals to him. Another may traverse the same ground and "shoot" the first thing that meets the eye and produce a picture that may gain him applause.

Such diversity of taste must establish the thought of art. Again, two artists may paint the same picture—one produces a work of art, the other a "buck-eye." In like manner two photographers, "shoot" the same object. One just sets up his camera, clicks it and sends the plate to the finishers; the other focuses around with various lenses, approaches the same group of trees from a little different angle, tries different exposures, waits several hours for the proper light, goes to his dark room and pets and nurses those negatives until they are just the right density and employs every trick in the printing. One makes merely a photograph, we view and say, "photography is an interesting science." We look at the other man's work and exclaim, "photography is a delightful art."

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## *An Open Letter*

(*Continued from Page 4*)

The public which is the final arbiter in the matter is murmuring already and soon will forcibly express its displeasure at the sacrifice needlessly imposed upon the photographic quality of sound pictures. These sacrifices can be greatly reduced and their ill effects palliated in a relatively short time if the cinematographer is given the facilities to become thoroughly familiar with the technicalities of sound control and NOT OTHERWISE.

The Fox organization has apparently realized the importance of the question and Mr. William Fox has expressed very clearly his attitude by stating that the advent of talking pictures has been the factor which has demonstrated the importance of cinematography and of the cinematographer.

To conclude, there is no doubt that the final solution of the present problems will come about by concentrating upon the cinematographer the responsibilities that he should assume and which should be conferred upon him.

How soon this situation will be recognized by you, Mr. Producer, is beyond our foresight, but one thing can be easily prophesied and that is, the sooner the situation is recognized the fewer heart-breaks, failures and financial losses will be suffered by the motion picture industry.

The Akeley Gyro Tripod may be had with either studio legs or news and outdoor legs.

Weight of tripod with studio legs — 30 lbs.
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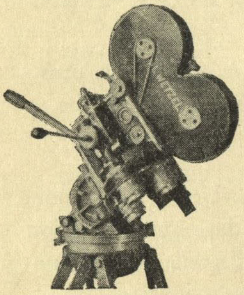
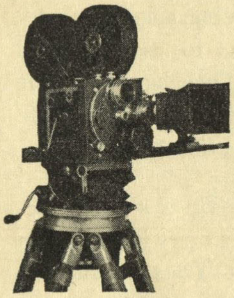
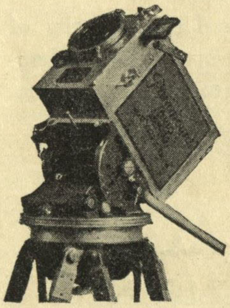
*NOW gives you . . . greater speed, flexibility, and precision with ANY make of camera*







The three views above show Bell and Howell, Mitchell, and De Brie Cameras mounted on the Akeley Gyro Tripod. A very clear idea may be gained from these shots of the maximum upward and downward tilt given to the camera by this Tripod.

REALIZING that the principles of the Akeley Gyro mechanism, as embodied in the Akeley Camera, have contributed greatly to the mechanical success of motion pictures, we have placed on the market a tripod in which is contained an improved gyro mechanism adaptable to *any* make of motion picture camera. This Gyro mechanism now gives to any camera advantages until now exclusive with the Akeley Camera.

The new tripod adds to all cameras the flexibility of the Akeley pan and tilt mechanism eliminating the use of crank handles and friction devices which Mr. Akeley found to be unsatisfactory in properly photographing follow shots. There are three different speeds or resistances in the pan, any of which may be selected by the operator. To insure ease of action the Akeley mechanism is entirely ball bearing.

Altogether the Akeley Gyro Mechanism provides for the motion picture photographer a more convenient, a quicker and a more profitable method of taking news or studio pictures. It makes the unusual picture an every-day occurrence, the heretofore impossible shot a simple matter.

*Write for our catalogue describing the Akeley Gyro Tripod in full and details of our time payment plan.*

**AKELEY CAMERA INC.**

*The Akeley Universal Gyro Tripod*

175 Varick Street New York City

# S. M. P. E.

*Abstracts of Papers Read at the Fall Meeting At Lake Placid, New York*

[*As* THE AMERICAN CINEMATOGRAPHER *goes to press the Fall meeting of the S. M. P. E. is in session at Lake Placid, New York. The program printed elsewhere in this issue is unusually interesting and* THE CINEMATOGRAPHER *takes this occasion to congratulate Mr. J. I. Crabtree, Chairman of the Committee on Papers and Publications, for his efficiency in getting together so excellent a collection of timely documents. As the Committee has not yet released the papers for publication in full* THE CINEMATOGRAPHER *must be content in this issue to publish the abstracts of those papers devoted to sound picture subjects. Later the principal transactions will be published in full*—EDITOR'S NOTE.]

## RE-VOCALIZED FILMS

By Edwin Hopkins,
New York, N. Y.

Restriction of international circulation of American made films on account of difference in language; the intrusion of extraneous sounds in out-of-door scenes; and the sad plight of personable screen players with untrained voices are all to be remedied.

By re-vocalizing films any voice or sound can be synchronized with an existing picture. Stars of the screen may thus look about, if they are dissatisfied with their own voices, and find new voices for their screen presences. It will also open up a new field for those whose tones may be dulcet, but whose features do not screen well.

As the re-placed voices may be in any language, the international problem will be solved. Immediately after the English speaking film is made, the same players on the same set will run through the actions in other languages, to get the correct lip movements, even though their accent may be bad. Foreign vocalists will then contribute the same words correctly spoken. A negative for every language will thus be needed, but as the bulk of the foreign market is covered by five languages, Spanish, French, German, Italian and Portugese, it will not be as difficult as it appears at first glance. This will not make Hollywood necessarily a Tower of Babel as the foreign re-vocalization may be carried out in New York or abroad as well as in Hollywood.

Directors may also direct vociferously as in the past if they so desire, instead of remaining silent as they do now in the sound recording.

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## A PROCESS OF INSERTING ACTION IN BACKGROUNDS

By Dodge Dunning
Dunning Process Co., Hollywood, Calif.

In a large feature production just completed in Hollywood, it was necessary to portray actors in a scene on the hills of Sorrento overlooking Naples as it appeared in 1793. Even a trip to modern Naples would not have sufficed. Therefore, a most elaborate miniature of the old city and the bay was built, covering five acres and faithful in every detail.

From the motion picture negative of this scene, a double-image balanced colored transparency was made and placed in the camera in front of an unexposed negative. The actors were photographed against a background complementary to the positive portions of the transparency thus securing a composite negative showing real actors walking along the foreground hills of an apparently ancient Naples in the distance. Several of the important scenes in the "Battle of Trafalgar" were likewise produced in this manner by the Dunning Process.

This process is not only adaptable to the purpose described but it also has enabled the motion picture studios of Hollywood to double expose actors into scenes previously taken in far-off locations.

## ACOUSTICS OF AUDITORIUMS

By Paul R. Heyl
Bureau of Standards, Washington, D. C.

Any continued interfering sound in an auditorium soon makes a condition which is unbearable to an audience. The usual defects of auditoriums are three: echo, dead spots, and reverberation. Echo is defined as a definite or articulate repetition of a sound after an interval of time equal to the duration of the sound. This defect is usually prevented by correct room shape. Dead spots occur in auditoriums where sound waves come together from different directions and neutralize each other making it impossible for a person located at such a point to hear much of anything. Dead spots are avoided by suitable shape of the walls and ceiling. Reverberation is a confused prolongation of sound and is likely to be excessive in rooms where the walls are constructed of materials which reflect sound strongly and absorb it only slightly.

## THE PRODUCTION OF THE PHOTOGRAPHIC IMAGE

By C. E. Kenneth Mees
Director of Kodak Research Laboratories, Rochester, N. Y.

A single motion picture examined under the microscope is found to be composed of tiny particles of silver which look like little masses of coke. These are derived from the crystals of silver bromide in the creamy white sensitive layer exposed in the camera, and there are more crystals on a square inch of the film than there are human beings on the surface of the globe.

Recently, scientists have determined how the atoms build up the crystals and have measured their sizes and shapes in different kinds of film. By careful adjustment of his processes the manufacturer includes a great range of sizes of crystals in his negative film, which enables the beautiful gradation to be obtained. A more uniform size of crystals in the positive film gives life and sparkle to the pictures.

The sensitiveness of the grains of silver bromide is increased by the presence of specks on them produced by an accidental impurity in the gelatine derived from plants eaten by animals from whose skins the gelatine is made. It contains sulphur, which reacts with the silver bromide and forms specks of silver sulphide on the crystals. Under light, this produces a trace of metallic silver and during development is a nucleus on which more silver deposits; finally the whole crystal becomes silver. These grains of silver compose the picture projected on the screen.

## ACOUSTIC LININGS FOR SOUND PROOF MOTION PICTURE STAGES AND SETS

By Frank S. Crowhurst
Crowhurst & Co., Hollywood, Calif.

Acoustical linings is a term used to designate those materials which have the property of largely absorbing sounds which fall upon their surfaces. In preparing stages for use in making motion pictures with sound records it is necessary to use construction materials which absorb in order to lessen reverberation and to eliminate foreign noises as largely as possible. A number of materials are available for this purpose and by the careful use of them it is possible to control the sound reflection from wall surfaces.

## CHARACTERISTICS OF PHOTO-ELECTRIC CELLS

By L. R. Koller
Research Laboratory, General Electric Co., Schenectady, N. Y.

In the photo electric cell light acts as a trigger for releasing and controlling electrical energy. Light falling upon a photo sensitive surface (connected in a suitable circuit) at once allows the passage of an electric current. The action differs from the usual conception of a trigger, however, in that the response of the cell, that is, the photo current, is proportional to the quantity of light falling upon the cell. Thus any variation in the intensity of the light falling upon a photo electric cell can be translated into similar variations of an electric current.

Many materials exhibit this property and can be used in the construction of photo cells. Those most commonly used are the alkali metals. Different materials differ not only in the total current which they will allow to flow for a given amount of light, but also in the portion of the spectrum to which they are sensitive. The photo cur-

rents are usually magnified by the introduction of a small amount of inert gas into the cell. The ionization of this gas results in as much as a ten fold amplification of the original photo current.

The current is then amplified by the methods familiar to radio engineers and put to a wide variety of uses from sorting cigars to reproducing sound or testing incandescent lamps.

## THE PUBLIC AND SOUND PICTURES

By William Johnston
Editor Motion Picture News, New York, N. Y.

The present form of motion picture entertainment is the result of a long process of evolution. Out of the original chaos emerged the feature photoplay which, for a time, dominated the field. Recent tendencies have been in the direction of a more balanced program, and this has meant a decline in prominence of the feature. The block booking system used as an outlet for inferior pictures has had an evil effect on the industry. The public cannot be forced to accept any picture.

Such was the situation when the development of the Vitaphone made possible the production of a picture with voice accompaniment. The effect of the appearance of "The Jazz Singer" was a general stimulation of the whole motion picture business. The apathy which had been shown by the public gave way to enthusiastic interest. The largest producing companies are planning future work with sound record accompaniment.

Sound record films will make the motion picture drama more expressive and more realistic. The sound film is expected to be of greatest value to the small communities and, in fact, to the patrons of all of the smaller theatres which have heretofore been deprived of the best of voices and music.

## GENERAL PRINCIPALS OF SOUND RECORDING

By Edward C. Wente
Bell Telephone Laboratories, Inc., New York, N. Y.

In the recording of sound there are in general four requirements that have to be met in order to get a faithful reproduction. The system must be free from frequency distortion, that is, sounds of all pitch must be recorded at intensities corresponding to their respective intensities in the original sound. The recording system must not introduce tones of frequencies other than those present in the sound being recorded; such extraneous sounds are generally introduced when any part of the system is overloaded. The record, whether it be a wax disc or a photographic film as in optical recording systems, must be driven at a uniform speed otherwise the reproduced sound will have a disagreeable flutter and in some cases a metallic tone quality. The system must be capable of operating over an extremely wide range of intensities in order to record properly the pianissimo and fortissimo parts of a slection played by a concert orchestra. Because of this requirement the structure of the recording medium, e. g., the wax or the photographic emulsion, must be of very fine grain otherwise an excessive amount of surface noise will be heard during the pianissimo portions of the reproduced sound.

## THE OPTICS OF SOUND RECORDING SYSTEMS

By Arthur C. Hardy
Massachusetts Institute of Technology, Cambridge, Mass.

This paper is concerned with the optical systems employed in the recording of sound on motion picture film. The optical requirements of the various methods of recording and reproducing are considered with special reference to the amount of light available with each system. Data are included to facilitate the comparison of the different systems or the design of a system to meet any special requirements.

## METHODS OF SYNCHRONIZING

By H. M. Stoller
Bell Telephone Laboratories, Inc., New York, N. Y.

Synchronization in the modern sound picture reproduction system using the wax disc is accomplished by mechanical connection between the sound record and the projector. This method of solving the synchronization

(*Continued on Page 31*)

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Dean, Faxon M.—

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Filden, William—

Gerrard, Henry William—Lasky.
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Roos, Len H.—c/o Pathe Review, Sidney, Australia.
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Dunn, Linwood G.—Metropolitan Studios.
Dyer, Edwin L—M. P. A. Studio, New Orleans.

Fitzgerald, Edward—M.-G.-M.

Giridlian, Jas. N.—
Greene, Al M.—
Greenhalgh, Jack—F. B. O.
Guffy, G. Burnett—De Mille.

Haas, Walter—
Harten, Charles—New York.
Head, Gordon G.—
Huggins, L. Owens—

Julian, Mac—

Keyes, Donald B.—First National.
Kealey, Joseph—

Landrigan, John S.—Lasky.
Lang, Charles Bryant—Lasky.
Longet, Gaston—F. B. O.
Lanning, Reggie—Lasky.
La Shelle, Joe—
Laszlo, Ernest—Tec-Art.
Lindon, Curly—

Marshall John R.—Fox.
Martin, Robt. G.—F. B. O.—Ralph Ince Prod.
Marta, Jack A.—Fox.
Merland, Harry—Lasky.
Mols, Pierre M.—M.-G.-M.
MacLean, Gordon—M.-G.-M.

Nogle, Geo. G.—

Pahle, Ted— F. B. O.
Palmer, Robt.—M.-G.-M.
Parsons, Harry—
Pittack, R. W.—Lasky.
Planck. Robt. H.—Columbia.
Pyle, Edwin L.—

Ragin, David—Fox.
Rand, Wm.—Lasky.
Ray, Bernard B.—
Redman, Frank—
Rees, Wm. A.—Warner Bros. Vitaphone.

Schmitz, John J.—
Schopp, Herman—
Shepek, John, Jr.—Educational.
Silver, John—
Smith, Jean C.—
Stine, Harold E.—

Tappenbeck, Hatto—Fox.
Terzo, Fred—
Thompson, John—

Unholz, George—Sennett.

Van Dyke, Herbert—M.-G.-M.
Van Enger, Willard—Warner Bros. Vitaphone.

Wagner, Robt.—First National.
Walters, Joseph J.—F. B. O.
Westerberg, Fred—
Williams, Alfred E.—Lasky
Rex, Wimpy—Lasky.
Witzel, E. L.—Universal.

# S. M. P. E. Abstracts

(*Continued from Page 27*)

problem makes necessary the use of very precise speed control in order to secure proper pitch of music or speech.

In recording, however, it is necessary to separate the camera and the sound recorder, and a special electrical interlock system has been designed for this purpose.

Specially designed motors are used for driving the camera and the recording device, and they are connected electrically in such a way as to prevent one from getting out of phase with the other.

## AN ELECTRICAL SYNCHRONIZATION AND RESYNCHRONIZING SYSTEM FOR SOUND MOTION PICTURE APPARATUS

By W. H. Bristol
Bristol Co., Waterbury, Conn.

When sounds accompanying the action in a motion picture are reproduced it is essential that the sounds are heard at the right moment in relation to the action; also that the sound reproduction apparatus be operated at a uniform correct speed so that the sound pitch will not be altered.

An electrical method of controlling the speed of movement of the sound record and of maintaining the desired time relation between the picture being shown and the sound being reproduced is described. This method permits of adjusting the relative positions of the picture and sound records as found necessary.

## RECENT ADVANCES IN "WAX" RECORDING

By Halsey A. Frederick
Bell Telephone Laboratories, Inc., New York, N. Y.

The frequency-response characteristics and limitations of the lateral cut "wax" record have been investigated. The conclusion is reached that the frequency range from 30 to 8,000 cycles per second can be recorded and reproduced from the record with practically negligible deviation from uniform frequency-response characteristic. Wax records have the advantage that they can be replayed immediately after recording as an aid in assisting the artist to obtain the best results. A brief description is given by Mr. Frederick of commercial processing methods, including both plating and pressing. These methods give essentially a perfect copy of the original "wax." Moreover, the time required for this work has been considerably reduced of late, so that a test pressing can be obtained within three hours of the cutting of the original "wax." The paper also brings out the fact that the material on the "wax" record can, by re-recording or "dubbing," be rearranged, portions eliminated or new portions or new sounds added, thus meeting the requirements imposed by editing, cutting or rearranging of the motion picture film with which the sounds are synchronized. It is brought out that the "dubbing" of records has been thoroughly established commercially and is no longer on a purely experimental basis. The "dubbed" record shows negligible change in quality from the original recording.

## SOUND REPRODUCTION IN THEATRES

By E. O. Scriven, Bell Telephone Labs. Inc., New York, N. Y.
and
H. B. Santee, Electrical Research Products Inc., New York, N. Y.

Sound reproducing, like sound recording equipment, must be designed to maintain a linear relation between stimulus and response. The solution of this problem requires the elimination of the effects of both mechanical and electrical resonance. This result may be accomplished by making use of apparatus in which the resonant point is outside the frequency range one wishes to reproduce or resonance at one point may be balanced against resonance at another.

The reproducer used with disc sound records is in part similar to the reproducer for phonograph use, except that it produces electric currents rather than sound waves. A beam of light and a photo-electric cell performs a similar function in the case of the film record.

(*Concluded on Page 33*)

# From the North Pole

## Or Thereabouts the A. S. C.'s North Europe Outpost Sends a Message Back to Civilization

By JOHN DORED, A. S. C.

From the deck of the ice-breaker, BRAGANZA, in search of Nobile and Amundsen, Mr. John Dored, A.S.C., our outpost in Northern Europe, sent The American Cinematographer recently the following communication.

At the time of his writing, Mr. Dored was only about four hundred and sixty miles from the North Pole, the BRAGANZA fast in the ice. Since receiving this letter, sent out by airplane and dog team, the ship has been released and Mr. Dored is again in Spitzbergen. The ship's position was 80:43 N. Lat.; 20:33 E. Long. Says Mr. Dored:

For a week we have had here wonderfully clear and sunny weather and under the light the Arctic looks inexpressibly beautiful. The sight of the Polar ice all around as far as the eye can see is simply gorgeous, unique, unforgettable. The polar packice has extremely beautiful formations, some of them transparent, of a deep green color. On one clear "sunny" night recently we observed a "Fata Morgana." From afar beyond the horizon an isle which is not seen ordinarily lifted itself gradually above the horizon and, having reached a certain height, hung up there in the heavens clearly for about an hour's duration, then gradually disappeared again. That isle was probably many hundreds of miles away from our location.

Once in a while we see polar bears in the distance, walking leisurely in their polar kingdom. Four of them we have been able to shoot for food.

Since June 23rd, the fine sunny weather which we had been enjoying for a week, changed late in the night to a fog, continuing up to the present time. Sitting in a dense fog, seeing just a bit further than one's own nose, is not very amusing, especially when one does not know how long a time he will be kept in the ice-prison. We think of the southern countries, think of the green, of the summer seaside bathing places—of all that we are deprived—no seabathing here—the water is 1½ degr.C. below zero. However, Spitzbergen was once a tropical country, millions of years ago. That theory is supported by the fossils found in Spitzbergen coal mines on which impressions of southern tree leaves are clearly seen. Also impressions of palm leaves are found in the mines. At the present time, however, there is no vegetation in Spitzbergen, whatsoever, the ground being frozen to 300 meters deep all year round.

I am not writing you anything about the Nobile affair; you will know all about that from the daily press. But it is a big disaster, claiming many human lives. It is the belief that but few of them will be saved.

I believe there has never been a professional motion picture outfit at work before at this high latitude and I am proud to be here as a member of the A.S.C., to record on the film some interesting scenes of the real Arctic.

By this time I know by heart every piece of ice, how high it is sticking up in the air, how deep it is down into the water, what form it has, and so on. I also know all about the different kinds of ice—the "Winter ice," "Pack-ice," "Drift-ice," "Polar-ice," Icefloors," Icefields," etc., etc. Can tell you now also all about the polar water currents, where they come from and where they go, as well as everything connected with winds, the South-west, South-east, North-west and so on.

Having swallowed all this valuable Arctic stuff and smoked my last cigar I came to think about the qualities that should be incorporated in the man called the news-camera-reporter of today, that he may be successful and avoid losing his job. I dope them out to be about as follows:

He must be:

1. **Physically strong**—To carry his heavy outfit as easily as a newly born baby. Be able to run, jump, climb, knock everybody over who is in his way.

2. **Persistent**—If thrown out through the door, must return through window and get the story.

3. **Endurable**—Eat once a day, sometimes less and not sleep for days, if that helps the story.

4. **Psychologist**—Must know from which side to approach the persons on whom depends the permit to get the story.

5. **Hypnotist**—Very valuable asset in hard cases.

6. **Daring**—War, revolt and many other dangerous situations.

7. **Vicious**—Necessary asset for obtaining story without permit. Also good to "beat" your friend-competitor.

8. **Quick-minded**—To grasp the situation at once and go to it without hesitation.

9. **Linguist**—Helps seventy-five per cent when traveling abroad.

10. **Sober**—Too many drinks are the worst enemy of the "reel" worker.

11. **Unmarried preferable**—To avoid matrimonial troubles, because never at home. Plenty of troubles without that.

12. **Artist**—To bring to the screen not only the "news" value but also artistry. That is where the "angles" come in, for which the editors are clamoring.

He must NOT BE:

13. **Stingy**—Entertaining and liberal tipping is quite essential, at least in Europe, to obtain results.

14. **Open Minded**—Ordinarily not a good quality, but necessary in "news" work. The story might otherwise cost too much money, or your friend competitor might get the "scoop." Never try to make real friends with your brother competitors—the friendship won't last long.

15. **Politician**—Must not belong to any political party, show up as a good friend of the "reds" when among them, —the same when with the monarchists.

16. **Too tall**—It would be hard to cover stories not permitted. The police would notice you too soon.

17. **Too small**—Would be hard to cover "mob" scenes from the ground, not being able to see what is going on.

What he must KNOW ALL ABOUT:

18. **Light**—To judge the photographic value of light at a moment's notice for correct exposure; re-takes not possible.

19. **Geography**—For instance in case you get an assignment to go from the North Pole to its South brother in five minutes notice.

20. **Traffic**—To get yourself or your story to the necessary destination in a humanly possible shortest time and get a "scoop."

These are but a few of the qualities which every news camera-reporter should possess or should not possess. I propose that this list be continued by you studio workers and my brothers in the profession in America.

---

The appellation of "photographer in chief" implies a real generalship on the part of Eddie Snyder, A. S. C., principal cinematographer of "The Tiger's Shadow," a Pathe serial produced by Phil Ryan. Acting under Snyder's command in photographing the serial, which comprises over 1,450 scenes, are five other trained cameramen, Lynn Dunn, Joe Davis, Walter Haas, Oliver Sigurdson and Clarence Slifer.

## *S. M. P. E. Abstracts*

(*Continued from Page 31*)

An engineering survey of a theatre for which an installation is intended reveals characteristics which determine the type and size of such equipment. The installation progresses in logical order to permit the operating personnel to become gradually familiar with its various portions. Different acoustic conditions in theatre auditoriums require that individual study be given in each case.

### RECENT DEVELOPMENTS IN DYNAMIC LOUD SPEAKERS

By John A. Minton and I. G. Maloff
Research Engineers, United Radio Corp., Rochester, N. Y.

The loudspeaker or the sound reproducer is the "neck of the bottle" in the sound movies. It must be free from frequency distortion, volume distortion, and wave shape distortion. Also it must be capable of delivering large sound outputs; it must be dependable and it must be economical as to initial cost, operation and maintainence. This paper discusses various types available from the viewpoint of these requirements. Results of research in this field are described in a paper on loudspeakers and a new type of high efficiency dynamic loudspeaker particularly adapted to sound movie work is described in detail.

### THE KERR CELL METHOD OF RECORDING SOUND

By V. Zworykin, L. B. Lynn and C. R. Hanna
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Two types of sound recording are in general use, defined according to the sound track produced, as variable area-constant density, and constant area-variable density. The Kerr Cell method is applicable to the latter type of recording.

The Kerr Cell system provides a light valve free from mechanically moving parts. Wide latitude of adjustment is possible which permits proper exposure and linear light modulation on the film. The recorder lends itself readily to portable equipment, because of its small size and very small power requirements.

A discussion and brief mathematical treatment of the theory of operation are given and experimental data to substantiate these are shown. Mention is also made of the photographic problems involved in variable density recording.

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FOR SALE—Complete 200′ "Universal" outfit—new automatic dissolve camera, good "Universal" tripod, two lenses, six magazines, masks, cases. Complete for $450.00. Will ship with privilege of examination, upon receipt of 25% of price. Thomas Baker, 604 W. Mercury Street, Butte, Montana.

FOR SALE—Bell & Howell Camera, 170 degree; four lenses F 3.5. New matt adapters 4 inch Iris, Light Tripod, four magazines, steel cases. B. Smith, 700 W. 1st Street. MEtropolitan 8205.

FOR SALE—Eyemo Camera. F 2.5 Cook lens, 6 spools and carrying case; in fine mechanical condition; cost new $275. For quick sale, $175.00. Frank Cotner, HOllywood 5046.

FOR SALE—Bell & Howell Camera, Fully equipped. Call GRanite 3830, George Meehan, A.S.C.

FOR SALE—Bell & Howell Camera No. 536. Inside Prizm and matt box; six magazines; Camera and Magazine case; also miscellaneous case with filters, gauze, etc. Thalhammer Iris. Outfit cost $3200.00. Will sell complete for $1500.00. Terms. Chas. E. Schoenbaum. OX-2771.

FOR SALE—Bell & Howell, excellent mechanical condition; six magazines; three cases. Brand new Astro F 2.3-50 mm Goerz 75 and 40 mm B. & H. tripod with Mitchell legs. Large single arm iris with B. & H. shade box, 4-way matt box, Gauze matt holder and two inch glass filter holder. $1,375 cash. Vernon Walker, 601 W. Fairmount St., Glendale, Cal., or A.S.C. offices.

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ONE two-inch Bausch & Lomb F.2:7; one Dahlmeyer Pentac 37 mm. F.2:9. Georges Benoit, care of American Society of Cinematographers, Hollywood, California.

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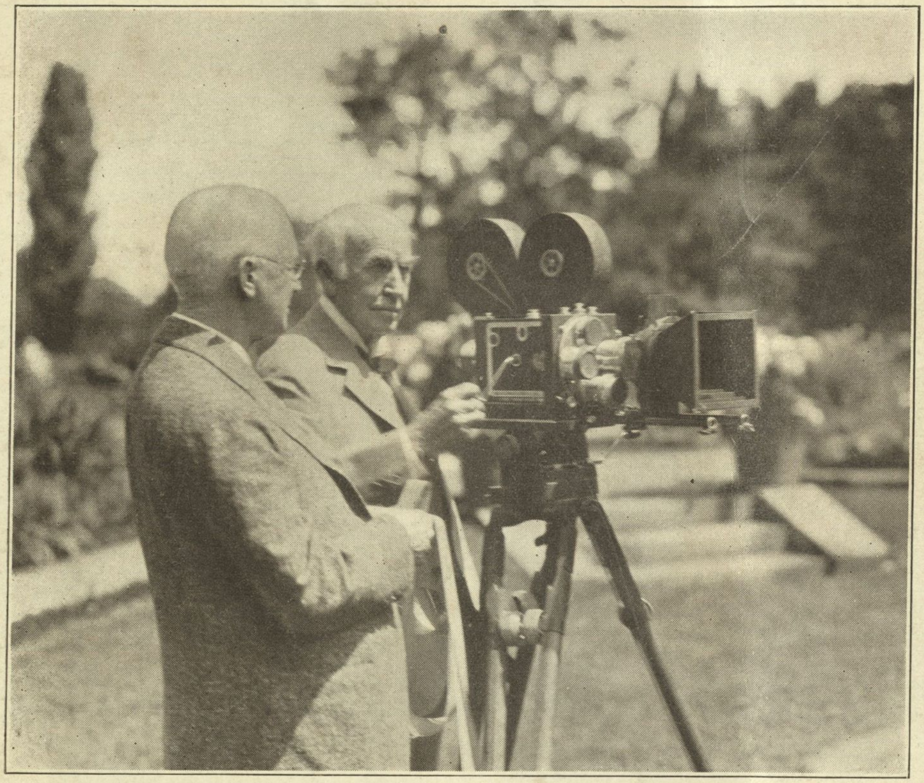

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